TECHNICAL MANUAL
FOR
WATER RECOVERY SYSTEM, STERILIZER

(Version 5.05.08)

NSN: 6530-01-541-4764
MODEL: WRS10
PART NO: WRS10-001

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WARNING

THE WATER RECOVERY SYSTEM (WRS) COMES FROM THE FACTORY SET FOR 115 VAC 60 HZ. THE WRS CAN RUN ON 230 VAC 50HZ, BUT A SWITCH MUST BE CHANGED WITHIN THE UNIT. PLEASE REFERENCE SECTION 3-4 ON PAGE 20 FOR THIS PROCEDURE. EQUIPMENT DAMAGE CAN OCCUR IF THE WRS POWER SYSTEM IS NOT SET UP PROPERLY.

WARNING

WHEN IN OPERATION, THE WRS CAN CAUSE BURNS IF THE WATER HOSE CONNECTORS ARE TOUCHED WITHOUT PROTECTION.

Use heat protective gloves or allow to cool before touching.

WARNING

HIGH VOLTAGE is used in the operation of this equipment.

DEATH MAY RESULT ON CONTACT

Be careful not to contact high voltage connections when installing or operating this equipment.

SHUT OFF and UNPLUG the POWER SUPPLY to the equipment before beginning to work on it.

NOTE

TO USE THE WRS, THE STERILIZER MUST HAVE THE ADAPTOR KIT INSTALLED. SEE APPENDIX F.

HOW TO USE THIS MANUAL

This manual provides a source of reference that will assist you in preparing and operating the WRS for use with the Sterilizer, Pressure, Steam, Electric or Gasoline burner Heated, Corrosion Resisting, NSN 65300-00-926-2151.

The manual is arranged in four chapters that are further broken down into sections. Appendices, figures (illustrations), and Tables are included to help you locate any item in this manual.

All paragraphs and figures are assigned numbers keyed to the chapter and sequence in which they appear. For example, figure 2-1 is the first figure in chapter 2 and figure 2-2 is the second figure in chapter 2. Pages are in numerical sequence.

To operate the WRS, you must know:

1. How to install, assemble,, and disassemble the equipment;
2. How to turn the WRS on and off;
3. How to fill the WRS and charge the 2151 with water;
4. How to drain the WRS and prepare for long term storage;
5. When the WRS is working properly and when it is not;
6. How to clean the WRS and perform preventive maintenance checks and services (PMCS);
7. How to use the trouble shooting procedures; and
8. When to call for help.

TECHNICAL MANUAL
for
WATER RECOVERY SYSTEM

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA form 2028-2 directly to: Commander, USAMMA, and ATTN: SGMMA-M, Frederick, MD 21701-5001. A reply will be sent to you.

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CHAPTER I

INTRODUCTION

Section 1. GENERAL INFORMATION

1-1. SCOPE

a. Type of Manual: Technical Manual

b. Equipment Name: Water Recovery System (WRS).

c. Purpose of Equipment: The WRS recovers and reuses condensate and exhaust steam from one or two Sterilizer(s), Surgical Instrument and Dressing, Pressure, Steam, Electric or Gasoline Burner Heated, Corrosion Resisting Metal, NSN 6530-00-926-2151, and pumps the recovered water back to the sterilizer(s).

d. Required 2151 Modifications: To use the WRS, the 2151 FIRST MUST BE MODIFIED by the installation of the 2151 Adapter Kit by Medical Maintenance. The adapter kit consists of hoses and fittings that conduct steam from the sterilizer to the WRS and water back to the sterilizer from the WRS.

1-2 MAINTENEANCE FORMS AND RECORDS. Department of the army forms and procedures used for equipment maintenance will be those prescribed by TB 38-750-2, Maintenance Management Procedures for Medical Equipment.

1-3 REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR). If your WRS needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you do not like about your equipment. Let us know why you do not like the design or performance. Put it on a SF 368 (Quality Deficiency Report). Mail it to us and we will send you a reply. Our address is:

Commander
USAMMA
ATTN: SGMMA-M
Frederick, MD 21701-5001

SECTION II. EQUIPMENT DESCRIPTION AND DATA

1-4 PURPOSE OF THE WRS. The WRS is designed specifically for use with the Sterilizer, Surgical Instrument and Dressing, Pressure, Steam, Electric, or Gasoline Burner Heated, Corrosion Resisting Metal, NSN 6530-00-9260-2151, hereafter called the 2151. The WRS captures the exhaust steam from one or two 2151's, condenses it into water, and pumps the water back to the 2151 boiler(s) when switched to the return mode. The WRS reduces water consumption of the 2151 from 2.5 gallons to less than 1 quart per sterilizer load.

1-5 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

1-5.1 Major Exterior Components, Front. The major exterior components of the front the WRS are shown in figure 1-1 and described below.

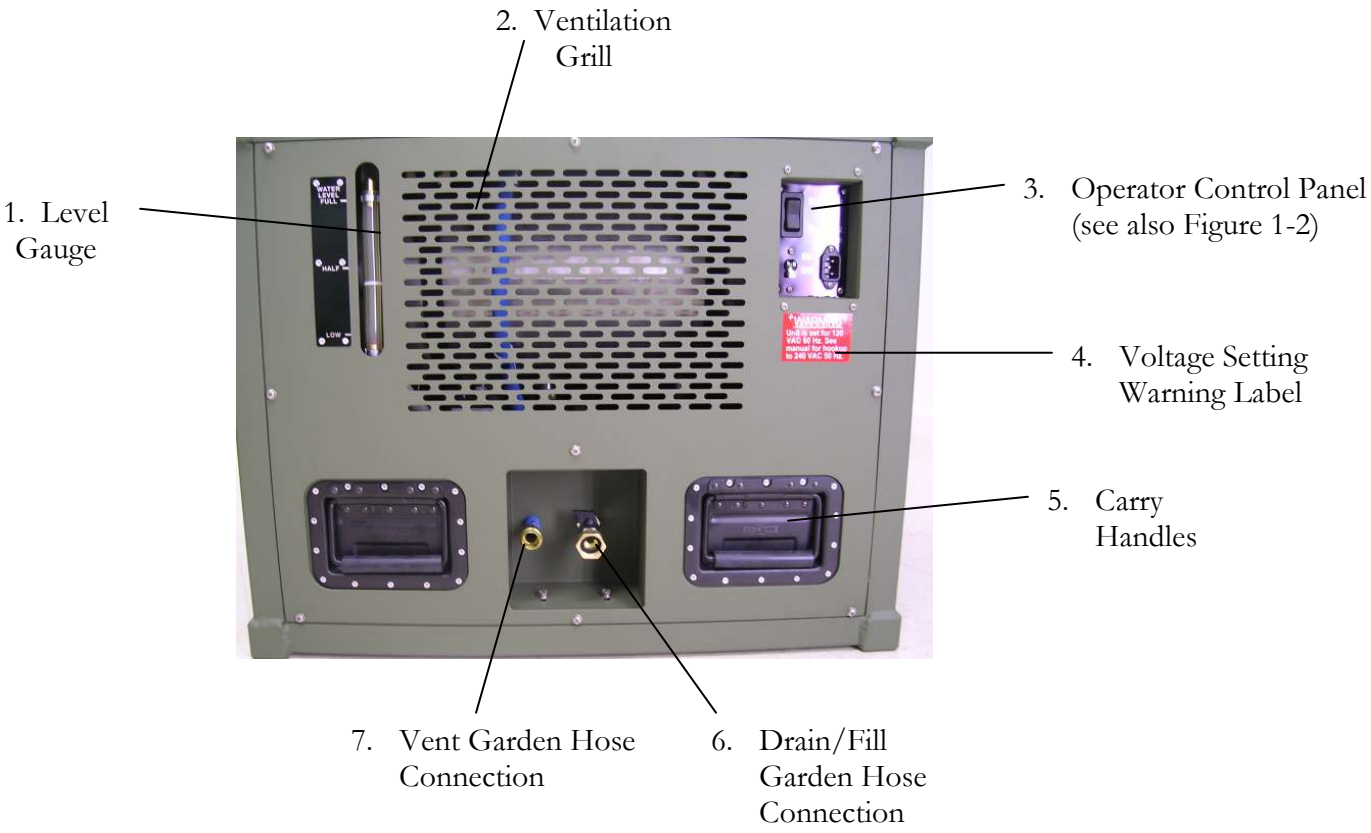

2. Ventilation Grill
1. Level Gauge
3. Operator Control Panel (see also Figure 1-2)
4. Voltage Setting Warning Label
5. Carry Handles
7. Vent Garden Hose Connection
6. Drain/Fill Garden Hose Connection

FIGURE 1-1. Major Exterior Components, Front

1. LEVEL GAUGE: Indicates the level of water in the tank. The WRS has a low level switch to prevent the pump from running dry and damaging the mechanical seal. The level switch is designed to shut the system off near the LOW level of the gauge.

2. VENTILATION GRILL: Allows fresh air to flow into the cooling coil fan inside the WRS.

3. OPERATOR CONTROL PANEL: Controls that the operator uses to start, stop, and charge water back to the 2151. See 1-5.2 for more details on this panel.

4. VOLTAGE SETTING WARNING LABEL: Warning to maintainer or operator that if 230 Volt 50 HZ power must be used, a setting must be changed within the electrical box of the WRS. Reference section 3-4 on page 20 for this procedure.

5. CARRY HANDLES: Heavy duty steel handles for two-person carry of WRS.

6. DRAIN/FILL GARDEN HOSE CONNECTION: Consists of small ¼ turn ball valve and female garden hose connection. Allows for the garden hose (provided in Adapter Kit) to be connected to the WRS to fill the tank with water. Also allows for unit to be drained when needed.

7. VENT GARDEN HOSE CONNECTION: Vent hose that connects to the top of the WRS to allow for unit to "breath" as water enters and exits. When the WRS is operating consistently under full load conditions, a slight amount of warm water vapor will exit this vent hose. A male garden hose connection is provided in case the Operator chooses to route this water vapor outside the enclosure.

1-5.2 Components of Operator Control Panel. Explanation of components within Operator Control Panel.

1. Water Return Switch
2. Power Switch
3. Power Connector

FIGURE 1-2: Components of the Operator Control Panel

1. WATER RETURN SWITCH: Initiates the flow of water from the WRS back to the 2151. Pushing the top portion of the rocker switch will charge water to Sterilizer #1. Pushing the bottom portion of the rocker switch will charge water to Sterilizer #2 (if connected).

2. POWER SWITCH: Turns electricity on and off to the WRS.

3. POWER CONNECTOR: Receptacle for the electrical cord provided in the Adapter Kit.

1-5.3 Major Exterior Components, Back. The major exterior components of the back of the WRS are shown in figure 1-3 and described below.

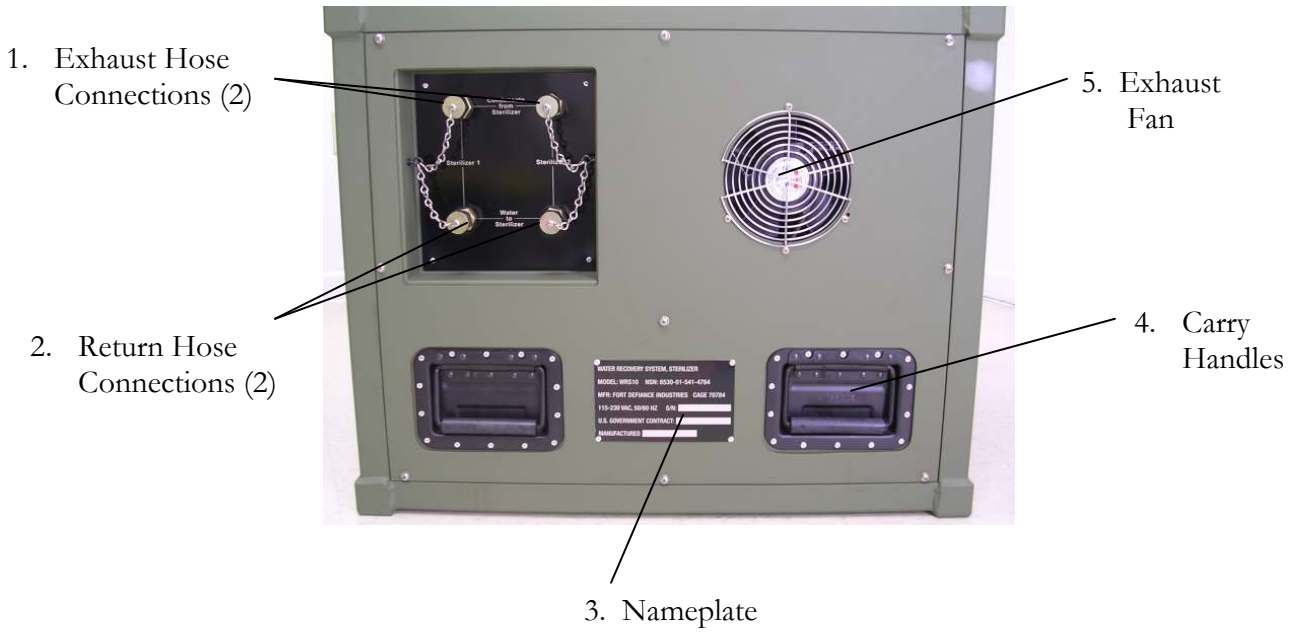


Figure 1-3. Major Exterior Components, Left Side

1. EXHAUST HOSE CONNECTIONS: The exhaust hose from the 2151 connects to one of two brass bulkhead fittings labeled "Condensate from Sterilizer". Two 2151's can be connected to one WRS.

2. RETURN HOSE CONNECTIONS: The return hose to the 2151 connects to one of two brass bulkhead fittings labeled "Water to Sterilizer". Two 2151's can be connected to one WRS.

3. NAMEPLATE: Data plate with key equipment information such as NSN, part number, etc.

4. CARRY HANDLES: Heavy duty steel handles for two-person carry of WRS.

5. EXHAUST FAN: Evacuates hot air from inside WRS to allow quicker water cooling. This fan only runs when the water temperature in the tank is above 130°F. Above 130°F, the cooling fan, exhaust fan and pump will operator automatically (assuming the power switch is ON).

1-5.3. Major Interior Components, Left View. The major internal components viewed from the left of the WRS are shown in figure 1-4 and described below.

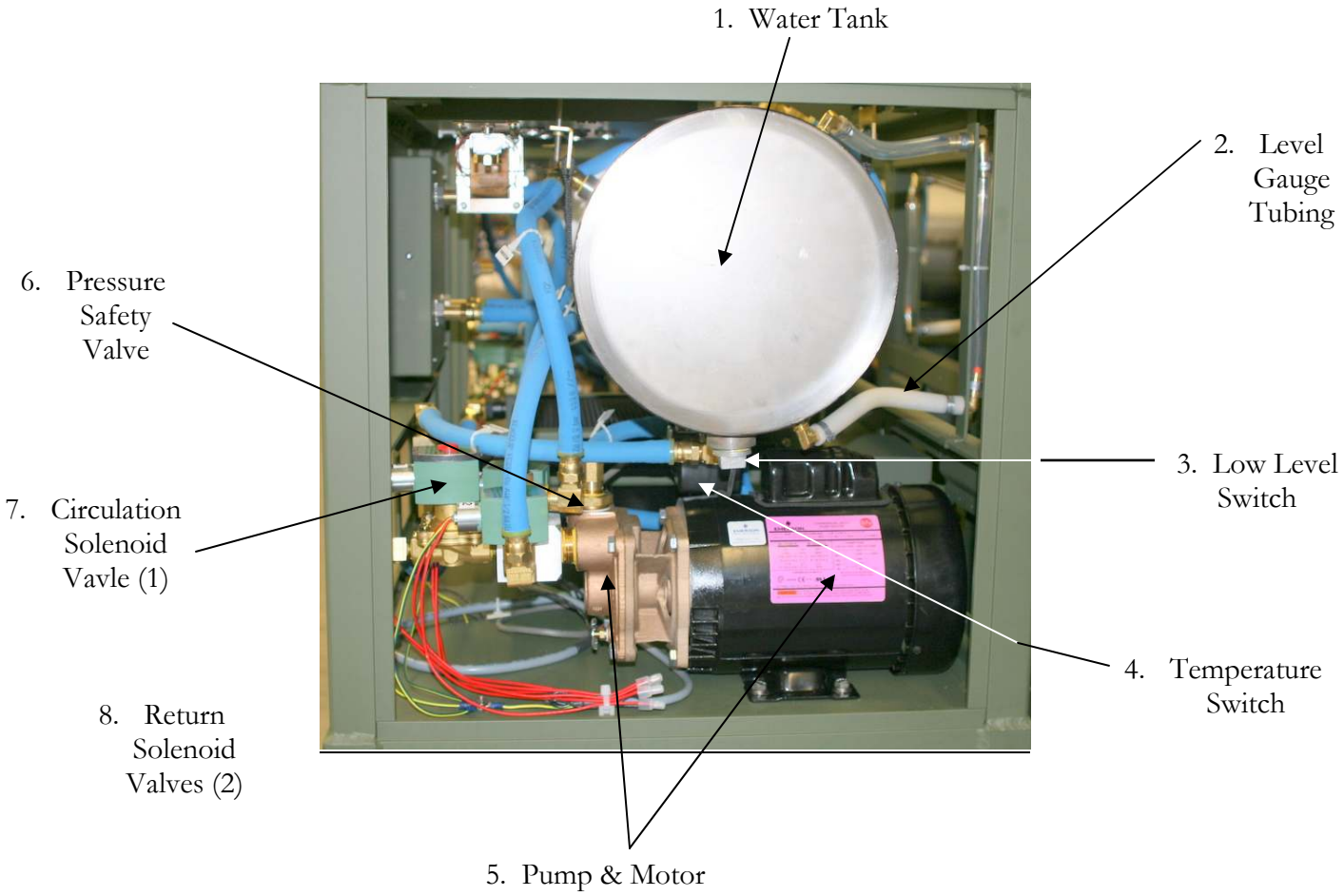

1. Water Tank
2. Level Gauge Tubing
3. Low Level Switch
4. Temperature Switch
5. Pump & Motor
6. Pressure Safety Valve
7. Circulation Solenoid Vavle (1)
8. Return Solenoid Valves (2)

FIGURE 1-4. Internal Components, Left View

1. WATER TANK: condenses the 2151 exhaust steam and stores the recovered water until it is ready to be pumped back to the 2151. Holds approximately 10 gallons.

2. LEVEL GAUGE TUBING: high temperature tubing that allows the external level gauge to show the water level inside the tank.

3. LOW LEVEL SWITCH: protects mechanical seal in pump from damage by preventing the pump from running unless there is a minimum level inside the tank.

4. TEMPERATURE SWITCH: difficult to see in picture, but this device cycles the pump, cooling fan, and exhaust fan on and off based on the water temperature inside the tank (all three components turn on and off at 130°F).

5. PUMP & MOTOR: circulate water through the WRS, or back to the 2151.

6. RETURN SOLENOID VALVES: these two valves control the flow of water that is pumped back to either Sterilizer #1 or #2. These two solenoid valves are identical, and are normally closed. These valves are activated (opened) by pressing the Water Return Switch (Figure 2-1).

7. CIRCULATION SOLENOID VALVE: this single valve controls the flow of water from the pump through the cooling coil and back into the Water Tank. This valve is normally open, and closes anytime the Water Return Switch is pressed to send water back to a 2151.

8. PRESSURE SAFETY VALVE: although not clearly shown in the picture, this valve is set at approximately 75 psig and opens to release water back into the tank to prevent overpressure of the pumping system if a flow path is blocked (e.g., trying to pump back to 2151 that is pressurized or the funnel plug is still in).

1-5.4. Major Interior Components, Right View. The major internal components viewed from the right of the WRS are shown in figure 1-5 and described below.

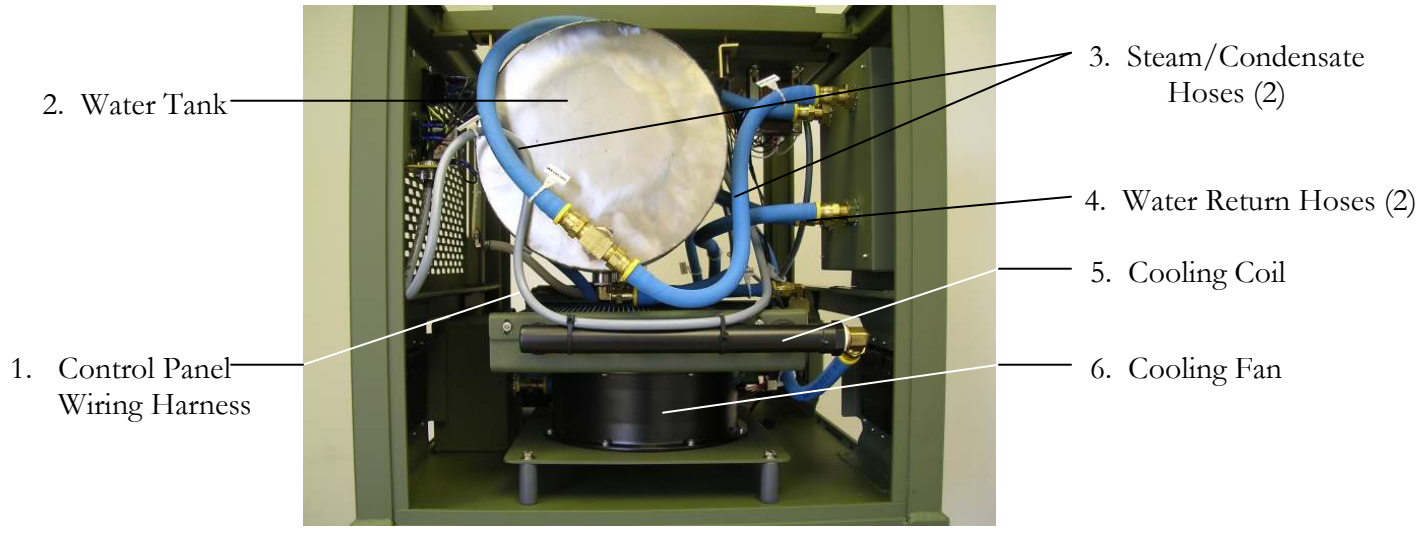


FIGURE 1-5. Internal Components, Right View.

1. CONTROL PANEL WIRING HARNESS: Electrical wiring from control panel to the electrical box on top of the WRS.

2. WATER TANK: condenses the 2151 exhaust steam and stores the recovered water until it is ready to be pumped back to the 2151. Holds approximately 10 gallons.

3. STEAM/CONDENSATE HOSES (2): high temperature hoses that carry steam and condensate from the exhaust hose of the 2151 into the Water Tank. The steam/condensate flows through a sparger tube inside the tank which allows the steam to condense more efficiently.

4. WATER RETURN HOSES (2): hoses that carry cooled water from the solenoid valves to the Return Hoses for the 2151.

5. COOLING COIL: heat exchanger (e.g., radiator) in which air flows through to cool the hot condensate.

6. COOLING FAN: fan that blows air through the cooling coil.

1-6 PHYSICAL DATA & SPECIFICATIONS

Length (sides with handles)	30.00 inches
Width	23.75 inches
Height	24.50 inches
Weight (empty)	184.5 pounds
Water tank capacity	10 gallons
Sound level (full load)	80.5 db
Return flowrate to sterilizer	3.5 gpm
Power AC—115 or 230 volt, 50/60 Hz, 1 Phase, 20 amp, 750 watts	

1-7. WATER SOURCES. Use potable water or water filtered to remove mud, sediment, and minerals that would clog the WRS solenoid valves or 2151 boiler(s).

1-8. DESCRITION OF OPERATING PRINCIPLES. Exhaust from the 2151(s) is discharged into and condensed in the WRS water tank. The water in the WRS is pumped from the water tank, through the cooling coil where it is cooled by the air from the cooling fan, and back to the water tank. The water circuit can be opened by a solenoid valve controlled by the water return switch to pump water back to the 2151 boiler(s).

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.

2-1. CONTROLS AND INDICATORS. The operator's controls and indicators are show in figure 2-1 and described in table 2-1 below.

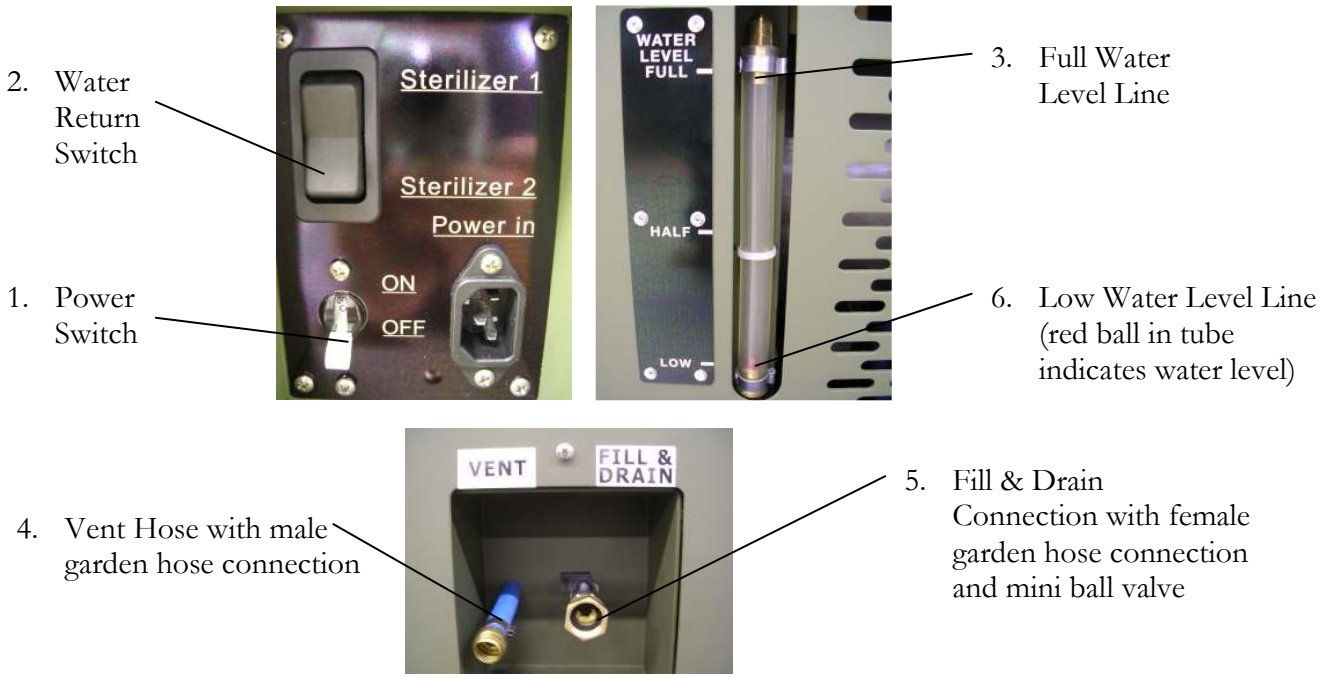


FIGURE 2-1. Operator's Controls and Indicators

TABLE 2-1. Operator's Controls and Indicators.

ITEM	CONTROL OR INDICATOR	FUNCTION
1	Power Switch	A two position switch that turns electricity on and off to the WRS. This switch also has the unit's 20 amp circuit breaker built into the switch.
2	Water Return Switch	A three position rocker switch that initiates water flow to either Sterilzer #1 or #2. Pushing the top portion of the switch will open solenoid valve #1, start the pump and charge water back to Sterilizer #1. Pushing the bottom portion of the switch will open solenoid valve #2, start the pump and charge water back to Sterilizer #2.
3	Full Water Level Line	Water level in the tank is indicated by the position of a floating ball inside the Level Gauge tubing. Keep the WRS at the half level line during normal operation, or at the high level line if the 2151 will be filled right away. Do not overfill. Overfilling will result in water flowing out of the Vent Hose.
4	Low Water Level Line	The water level should always be maintained between the Full and Low lines on the Level Gauge. If the water level becomes too low, the Low Level Switch (located underneath the tank near the motor) will activate and prevent the unit from running which could damage the pump seal. If this happens, water must be added to the WRS.
5	Drain & Fill Connection	The garden hose supplied in the Adapter Kit can be connected to the garden hose fitting for filling the WRS with water or draining. A mini ball valve is provided to control flow of water into and out of the WRS.
6	Vent Hose	Vent hose that allows the tank to breath as steam and water enter and exit the tank. If desired, a garden hose can be attached to this connection to vent any moist air outside of the enclosure.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-2. PCMS TABLE. Table 2-2 provides instructions for PMCS at the operator's level.

a. The heading, Item to be Inspected, describes the item to be inspected.

b. Each item to be checked is numbered in the first column, Item No. Always do PMCS in the same order according to this number. The number is to be used for the TM number column on the DA Form 2420, Equipment Inspection and Maintenance Worksheet, in recording the results of PMCS.

c. The second column of the table, Interval, shows the interval at which the check is to be performed. An asterisk (*) is shown in the appropriate sub column to identify the frequency with which it should be performed. All PMCS are to be performed as scheduled and under the following conditions:

1) When equipment is installed.

2) When equipment is reinstalled after being moved/removed for any reason.

d. The third column of the table, Procedure, provides instructions for performing the check. If corrective action is indicated, the required instructions are provided here.

e. The last column, Equipment is not Ready/Available, tells why the WRS should not be used until repaired, identifies the problem, and gives the procedure for correction. Report any deficiencies using proper forms (see TM 38-750). Any defects noted that are beyond the scope of the Organizational Maintenance shall be reported immediately to the maintenance supervisor.

f. If something does not work, troubleshoot with instructions in the manual (Chapter 3, Section II, p 21) and tell your supervisor or call Medical Maintenance.

g. All PMCS can be performed with the POWER ON.

TABLE 2-2. Operator's Preventive Maintenance Checks and Services (PMCS)

NOTE: These PMCS are to be performed in the order listed.

B—Before daily operation D—During operation A—After operation W—Weekly

	INTERVAL					
Item	**B**	**D**	**A**	**W**	**ITEMS TO BE INSPECTED PROCEDURE**	**EQUIPMENT IS NOT READY/AVAILABLE IF:**
1	*	*			**WATER LEVEL:** Water level in tank must be above the low level line.	Below the low level line. Keep water level near the mid level line during normal operation, or at the full level line if the 2151 needs filled.
2	*	*			**HOSE CONNECTIONS & BASE:** Inspect hose connections and the base (around front/back panel) for any signs of water leakage.	Water is observed leaking from the WRS. Call Medical Maintenance.
3	*				**ELECTRICAL CORD & HOSES:** Inspect electrical cord and hoses for signs of damage, excessive wear, or loose and improper connections.	The cord or hoses are excessively worn or damaged. Call Medical Maintenance.
4		*			**WATER LEVEL:** Water level in tank should only drop if pumping water back to a 2151.	Water level drops while in cooling cycle (pump is recirculating hot water through cooling coil and fans are running), but Water Return Switch is not being pressed. Call Medical Maintenance.
5		*			**WATER LEVEL:** Pump should not run if water level drops at or below Low Level Line.	Pump continues to run even though water has fallen below the Low Level Line. Call Medical Maintenance.

Item	B	D	A	W	ITEMS TO BE INSPECTED PROCEDURE	EQUIPMENT IS NOT READY/AVAILABLE IF:
6		*			**PUMP & FANS:** Pump and cooling fans should automatically shut off when water cools to below 130°F. Pump and fans should turn on anytime water is hotter than 130°F.	The pump and fans continue to run even though it is clear that the water in the tank is cooler than 130°F – or the pump and fans do not turn on even though it is clear that the water in the tank is hotter than 130°F. Call Medical Maintenance.
7		*			**PUMP, VALVES, & FANS:** Feel and listen for any unusual vibrations or noises (e.g., grinding, chattering) coming from inside the WRS during operation.	Any unusual vibration or noise is observed. Stop running the WRS immediately. Call Medical Maintenance.
8		*			**PUMP TIME TO 2151:** Check time to pump water back to 2151.	It takes longer than 4 minutes to pump a full tank (10 gallons) back to the 2151. Call Medical Maintenance.
9				*	**WATER TANK:** Drain water from the tank by attaching the garden hose to the drain connection. Place the other end of hose in a pail and water will gravity flow.	Water contains rust, sediment, or lint. Drain completely and refill with potable water.
10				*	**COOLING COIL:** Shine a flashlight through the front grill to inspect the cooling coil for dust & debris build-up that could inhibit proper cooling.	A noticeable build-up of dust is on the cooling coil fins. Call Medical Maintenance.

Section III. OPERATING INSTRUCTIONS

2-3. PREPARATION FOR USE. To prepare the WRS for use, follow these steps:

a. The 2151(s) should have already been modified with the 2151 Adapter kit by Medical Maintenance. (You can't operate the WRS without these modifications and components). Reference Appendix F. **These instructions include attaching the exhaust and return hoses, electrical cord, and garden hose.**

b. Ensure the WRS power switch is in the OFF position.

c. Fill the water tank. Ensure valve at the Drain/Fill Connection is in the OFF position (black handle will be turned sideways – not inline with the valve & hose). Turn on faucet. Come back and open the fill valve until water reaches the high level line. Close the fill valve and turn faucet off. (Figure 2-1)

d. Turn the WRS power switch to the ON position.

e. If the 2151 sight glass reads low or empty, the 2151 boiler can be filled easily from the WRS. Press the WRS water return switch up or down (depending on which 2151 you are filling), and allow the 2151 to fill until the water level in the 2151 sight glass reaches full, and then release the switch.

f. Turn the power to the 2151(s) on in accordance with the 2151 Operating Manual.

g. Follow the normal operating procedures for the 2151. With the WRS connected, steam will now be exhausted into the WRS tank where it will be condensed into water. During the exhaust cycle, you will hear the steam and condensate flowing through the exhaust hose and into the water tank on the WRS.

h. After each 2151 operating cycle, check the 2151 water sight glass. When the water in the sight glass is below one quarter full, add water by pressing the WRS water return switch up or down (depending on which 2151 needs water). When the 2151 sight glass reads full, release the water return switch and water will stop flowing to the 2151. Always add water back to the WRS if the 2151 was just filled. Do not overfill the WRS since exhaust steam and condensate will be returning to the WRS after the next 2151 cycle. Keep the WRS water near the mid level line during normal operation, or at the full level line if the 2151 needs filling.

2-4. PREPARATION FOR SHUTDOWN:

a. Listen for the hum of WRS pump and fans. If the pump and fans are still running, allow the WRS to continue cooling the water until the fans shut off automatically. This will happen at approximately 130°F.

b. When the pump and fans have stopped running, turn the WRS power switch off.

2-5. PREPARATION FOR MOVEMENT AND/OR STORAGE:

a. Shutdown the WRS as described in section 2-4.

b. Disconnect the power cord from the power source and the WRS.

c. Unscrew the garden hose from the water faucet. Once this end of the hose is lower than the WRS water tank, water from the tank will drain out. Therefore, put this end in a suitable place to empty as much as 10 gallons of water (a pail or onto the ground outside). Open the drain valve on the WRS and allow the water to gravity drain.

d. Open the petcock valve on the bottom of the pump and keep this open until water stops dripping out. CAUTION: If the pump contains any water, it could freeze in a cold storage environment and crack the pump casing.

e. Allow the 2151 to cool until the boiler pressure is 0 psig. Disconnect the exhaust and return hoses form the 2151(s) and the WRS exhaust and return connectors. Install the hydraulic caps on the WRS exhaust and return connectors. See Appendix F (Adapter Kit installation instructions if needed.)

f. If compressed air is available, gently blow air through the drain/fill connection and the vent connection to ensure all water is evacuated from WRS.

g. Remove the garden hose from the garden hose connector and close the drain valve.

h. Close the petcock valve on the pump.

i. Drain, coil, and place the garden hose, exhaust hose, return hose, and electrical cord in a suitable container that will stay with the WRS. Store the Technical manual in a plastic bag and put it with the aforementioned items.

Section IV. OPERATING UNDER UNUSUAL CONDITIONS

2-7. HIGH AMBIENT TEMPERATURES. When the outside temperature is high (100°F or greater), water must circulate through the cooling coil for a longer time to cool. If the 2151s are in constant use, steam my discharge from the vent hose. If this happens, the water in the WRS is not cooling fast enough. Delay the start of the next 2151 cycle until the WRS fans and pump shut off automatically. The best time to sterilize is in the cool evening, night, and early morning hours.

2-8. LOW AMBIENT TEMPERATURES. When the outside temperature is low (32 degrees F or less), start up and run one of the 2151s attached to the WRS. Operate the 2151 through a sterilizer cycle every 2-3 hours to keep the water in the WRS from freezing. Alternate 2151s to keep them from freezing.

2-9. DUSTY, HOT ENVIRONMENTS. During operation in dusty, hot environments, care must be taken to keep the cooling coil free of dust or debris that could cause overheating. Clean the cooling coil as needed using compressed air and a fine bristle brush (if available). Be careful not to damage the delicate fins on the coil, which will reduce cooling efficiency.

2-10. EMERGENCY PROCEDURES. If the WRS is disabled because of major leaks(s), electrical failure, or pump failure, the 2151 can still be operated according to the instructions below:

a. Disconnect the WRS from the 2151 (see section 2-5). After removing the exhaust hose and return hose from the 2151, be sure to install the hydraulic caps on the Steam Trap Assembly and the Return Connector.

b. Call Medical Maintenance to remove the steam trap plug on the bottom of the 2151 and place a pail on the floor below the plug to catch the exhaust.

c. Check the water level of the 2151, and fill if necessary (see "Instruction Manual for Sterilizer, surgical Instrument and Dressing, Pressure, Steam, Electric or Gasoline Burner Heated, corrosion Resisting Metal," page 6 for directions).

d. Turn the 2151 heat switch on and continue sterilization. Be sure to monitor the water level periodically in the 2151.

CHAPTER 3

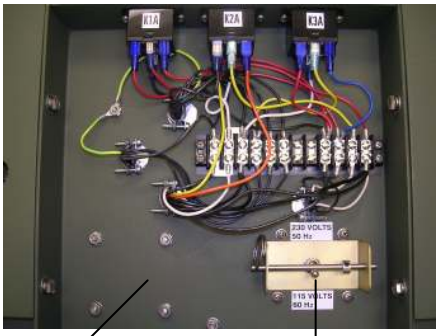
MAINTENANCE INSTRUCTIONS

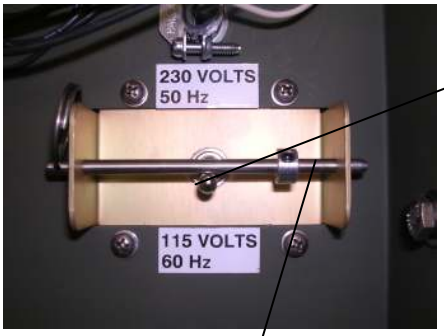
3-1. LUBRICATION. There is no scheduled lubrication required. The electric motor has sealed bearings and does not require greasing. If the panel fasteners (screws) become hard to turn, apply a light coat of machine oil (use lubrication oil, item 2, Appendix D) to the screw shaft.

3-2. PUMP SEAL REPLACEMENT. See the enclosed pump manual (Appendix H) for repairs and maintenance (e.g., replacement of the mechanical seal).

3-3 SOLENOID VALVE INSPECTION & REPAIR. If you would like a procedure for solenoid valve inspection and repair, please contact Fort Defiance Industries at (865) 408-0100 or techsupport@fortdefianceind.com.

3-4 CHANGING ELECTRICAL SETUP FROM 115 VOLTS 60 HZ TO 230 VOLTS 50 HZ.





4. Toggle Switch

1. Electrical Box Under Top

2. Voltage Selector Switch

3. Safety Pin

a. Ensure WRS is electrically isolated (e.g., remove power cord)
b. Remove top panel using flathead screwdriver
c. Pull the Safety Pin from the mounting bracket
d. Flip the Toggle Switch to the 230 Volt 50 Hz setting
e. Reinstall the Safety Pin
f. Reinstall the top panel
g. Energize the WRS using 230 Volt 50 Hz power

WARNING: Be sure to reverse this procedure when going back to 115 volts 60 Hz

Section II. TROUBLESHOOTING PROCEDURES

Table 3-1 lists the common malfunctions you may find during the operation of the WRS or its components. Only Medical Maintenance should perform the tasks in the right hand column.

This manual can't list all malfunctions that may occur, all tests or inspections, and all corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

WARNING

If the WRS has been used recently, the fans and pump should be allowed to finish cooling and shut off automatically. Turn off the power supply and unplug the power cord at the source before tests or inspections.

TABLE 3-1. Troubleshooting Procedures for the WRS.

SYMPTOM	POSSIBLE CAUSE	OPERATOR TEST OR INSPECT	MEDICAL MAINTENANCE CORRECTIVE ACTION
1. 2151 is not refilling at all	**1.1** Pump not running	Listen for pump running or touch motor when the Water Return Switch is pressed or during normal cooling cycle (when fans are running). If the pump does not run in either mode, call Medical Maintenance.	Inspect the motor, and possibly replace.

SYMPTOM	POSSIBLE CAUSE	OPERATOR TEST OR INSPECT	MEDICAL MAINTENANCE CORRECTIVE ACTION
	1.2 Pump not running	Level switch. The pump will only operate if the level switch closes. Call Medical Maintenance.	Cut power the WRS. Remove top panel and install a jumper wire between the front terminal blocks #10 and #11. If the pump operates, then the switch is faulty. Inspect or replace level switch.
	1.3 Pump not running	If none of the other tests provide an answer, then Relay #2 in the electrical box may be faulty. Call Medical Maintenance.	Using a multipurpose meter, check the functionality of relay #2 in the electrical box (under top panel). Replace if faulty.
	1.4 Solenoid Valve #1 or #2 not opening	If the WRS is connected to two 2151's, and neither 2151 will fill, then it is probably not a solenoid problem. Otherwise, remove a return hose from the 2151 and stick into a bucket. Press the water return switch and see if water flows into the bucket. If the pump runs, but not water flows, call Medical Maintenance.	Disassemble the solenoid valve. It is most likely plugged with debris, or the coil could be bad. If you would like a procedure for solenoid valve inspection and repair, please contact Fort Defiance Industries at (865) 408-0100 or via email at techsupport@fortdefianceind.com.

SYMPTOM	POSSIBLE CAUSE	OPERATOR TEST OR INSPECT	MEDICAL MAINTENANCE CORRECTIVE ACTION
2. 2151 fills very slowly (e.g., over 4 minutes)	**2.1** Solenoid valve #3 not closing	The center solenoid valve #3 is normally open during normal circulation. This valve closes when the water return switch is pressed to allow all the pump output to go to a 2151. Call Medical Maintenance.	Cut power to the WRS. Drain hot water and refill with cold water. Remove the top panel, and install a jumper wire between the front #9 and #12 terminal blocks. Disconnect the solenoid valve blue hose at the cooling coil and route into a bucket. Turn on WRS. Pump will run and water will shoot out of the hose. Press the water return switch. If water keeps coming out of the hose, then the solenoid valve is leaking by. If you would like a procedure for solenoid valve inspection and repair, please contact Fort Defiance Industries at (865) 408-0100 or via email at techsupport@fortdefianceind.com.
3. WRS will not run at all.	**3.1** Water level too low.	Ensure water level is well above the low level line. If below the low level line, the low level switch will prevent the pump from running to protect the mechanical seal inside.	
	3.2 No electrical power	Ensure WRS switch is ON. Ensure electrical cord is plugged in at both ends. Check external power source for defects. Call Medical Maintenance	If items at left all check out, the circuit breaker could be blown in the WRS. A 20 amp circuit breaker is built into the power switch. Turn switch off and then back on to see if it will reset. If not, test with a meter. If faulty, replace switch.

SYMPTOM	POSSIBLE CAUSE	OPERATOR TEST OR INSPECT	MEDICAL MAINTENANCE CORRECTIVE ACTION
4. Pump and fans won't operate during normal cooling cycle, but unit will pump to a 2151.	**4.1** Temperature switch faulty	Call Medical Maintenance	Cut power to the WRS. Remove the top panel, and install a jumper wire between the front #9 and #12 terminal blocks. Turn on WRS. If fans and pump operate, then the temp switch is faulty. Replace temperature switch.
5. Water leaks from WRS	**5.1** Tank overfilled	Ensure that water level is below the high level line.	
	5.2 Hose fitting loose	Remove panels and inspect hose connections.	Tighten brass hose fittings.
	5.3 Pump leak	Inspect under the pump for leaks. If the pump is leaking, call Medical Maintenance.	If the leak is coming from the pump casing where the two pump pieces mate, then try tightening the four bolts around the casing. If the leak is coming from the rear of the pump (near the motor shaft), then the mechanical seal is leaking. See the pump manual in Appendix H.
6. Steam coming out of vent hose	**6.1** Cooling fans and pump are not operating	See 4.1 above.	
	6.2 Pump is running but cooling fan is not running.	Remove a panel and check to see if the cooling fan underneath the coil is rotating. If not, call Medical Maintenance.	Trace wires from cooling fan and test with multimeter to see if power is getting to fan motor. If this is OK, fan motor is likely faulty. Replace cooling fan.

Section III. OPERATOR MAINTENANCE

3-3. OPERATOR MAINTENEANCE TASKS.

3-3.1 Drain the water out of the water tank at least once every 200 hours of operation and refill with potable water.

3-3.2 Inspect the cooling coil by shining a flashlight through the grill on the front of the WRS. If dust and debris is visable, the cooling efficiency of the unit may be reduced. Remove the right panel using a flathead screwdriver and clean the fins of the cooling coil using compressed air and a soft-bristled brush (if available). Be careful not to bend the fins on the coil, as they are delicate. Bending the fins will reduce airflow and cooling efficiency.

CHAPTER 4

MAINTENANCE OF AUXILIARY EQUIPMENT

See "Instruction Manual for Sterilizer, Surgical Instrument and Dressing, Pressure, Steam, Electric or Gasoline Burner Heated, Corrosion Resisting Metal," for instructions on maintenance of 2151(s).

APPENDIX A

REFERENCES

A-1. SCOPE:

The following items can be used with this manual and should help you if needed.

A-2. ARMY REGULATIONS

Army Medical Treatment Facilities: General Administration	AR 40-2
Sterilizing Medical, Surgical, Dental, Veterinary Material	AR 40-19
Medical Logistics, Policies, and Procedures	AR 40-61

A-3. FIELD MANUALS:

Evacuation of the Sick and Wounded	FM 8-35
Centralized Material Service/Selection	FM 8-38
Introduction to Operating Room Technique (6th Ed)	FM 8-73
Soldier's Manual 91B, Medical Specialist (Skill Level ½)	FM 8-91B1/2
Soldier's Manual 91B, Medical Specialist (Skill Level 3)	FM 8-91B3
Soldier's Manual 91B, Medical Specialist (Skill Level 4)	FM 8-91B4
First Aid for Soldiers	FM 21-11

A-4. TECHNICAL MANUALS:

Instruction Manual for Sterilizer, Surgical Instrument and Dressing, Pressure, Steam, Electric or Gasoline Burner Heated Corrosion Resisting Metal, NSN 6530-00-926-2151	
Maintenance Management Procedures for Medical Equipment	TB 38-750-2
Operator's Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools List) for Water Recovery System	TM X-XXXX-XXX-14&P

APPENDIX B

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS (B11) LISTS

B-1. SCOPE

The Components of End Item and Basic Items Lists are divided into the following sections:

a. Section I. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts.

b. Section II. Basic Issue Items. These are the minimum essential items required to place the WRS in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the WRS during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

B-2. EXPLANATION OF COLUMNS

The following provides an explanation of columns found in the tabular listing:

a. Column (1)—National Stock Number. Indicates the National Stock Number assigned to the item and will be used for requisitioning purposes.

b. Column (2)—Description. Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the Federal Supply code for Manufacturer (FSCM) (in parentheses) followed by the part number.

c. Column (3)—Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (each-ea., inch-in., pair-pr.).

d. Column (4)—Quantity required (Qty rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

Section II. COMPONENTS OF END ITEM

(1) National Stock Number	(2) Description FSCM and Part Number	(3) U/M	(4) Qty rqr
	POWER CORD, 115 V	ea.	1
	KIT, 2151, ADAPTER	ea.	1
	RETURN HOSE	ea.	1
	EXHAUST HOSE	ea.	1
	GARDEN HOSE	ea.	1

APPENDIX C

ADDITIONAL AUTHORIZATION LIST

C-1. SCOPE

This appendix lists nonexpendable supplies and equipment needed to operate and maintain the WRS.

C-2. GENERAL

This list identifies items that do not have to accompany the WRS and that do not have to be turned in with it. These items are all authorized by you by CTA, MTOE, TDA, or JTA.

C-3. EXPLANATION OF LISTING

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i.e., CTAZ, MTOE, or JTA) which authorizes the item(s).

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION FSCM & PART NUMBER	(3) USABLE ON CODE	(4) U/M	(5) QTY AUTH
1. 7240-00-160-0455	PAIL, utility: 14 qt capacity	EA	1	1
2. 6685-01-070-1510	THERMOMETER, self-indicating liquid (mercury)	EA	1	1
3. 7240-00-001-0978	PAN, polyethylene w/o cover 13 ½ X 11 ½ X 5 ⅜	EA	1	1
4. 8415-01-092-3910	GLOVES, heat protective, Type II	PR	1	1

APPENDIX D

EXPENDABLE SUPPLIES AND MATERIALS LIST

D-1 SCOPE

This appendix lists expendable supplies and materials needed to operate and maintain the WRS. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

D-2 EXPLANATION OF COLUMNS

a. Column (1)—Item number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use Cloths, cleaning, item 1, Appendix D").

b. Column (2)—Level. This column identifies the lowest level of maintenance that requires the listed item.

c. Column (3)—National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column (4)—Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.

e. Column (5)—Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1.	C	7920-01-004-7848	Cloth, cleaning	1 rl
2.	C	9150-00-235-5589	Lubricating oil	2 oz
3.	C	7930-00-664-6910	Glass cleaner	1 bx

APPENDIX E

PARTS LIST

*Note: Items 1 through 7 are considered critical spare parts. Fort Defiance Industries, Inc. strongly suggests keeping these items readily available to ensure high uptime of the WRS.

Item	Description	Part No.
1.*	Valve, Solenoid #1 or #2 repair kit	WRS-C-017
2.*	Valve, Solenoid #2 repair kit	WRS-C-018
3.*	Mechanical Seal, Pump	WRS-C-026
4.*	Relay, Electrical, K1A & K3A	WRS-C-009
5.*	Relay, Electrical, K2A	WRS-C-029
6.*	Relay, Electrical, K4A	WRS-C-030
7.*	Switch, Power (with integrated 20 amp circuit breaker)	WRS-C-010
8.	Fan, Cooling Coil	WRS-C-024
9.	Fan, Cabinet Exhaust	WRS-C-025
10.	Switch, Water Return	WRS-C-011
11.	Switch, Level	WRS-C-012
12.	Switch, Temperature	WRS-C-013
13.	Switch, Voltage Selector	WRS-C-014
14.	Snubber, SN1	WRS-C-031
15.	Transformer, Electrical (240 volts to 120 volts)	WRS-C-015
16.	Motor, Electric, ¾ HP, 120/240 volts, 50/60 Hz	WRS-C-016
17.	Pump, (entire)	WRS-C-028
18.	Impeller, Pump	WRS-C-027
19.	Valve, Drain (mini ball)	WRS-C-019
20.	Valve, Solenoid #1 or #2 (entire unit)	WRS-C-020
21.	Valve, Solenoid #3 (entire unit)	WRS-C-021
22.	Valve, Pressure Safety	WRS-C-022
23.	Coil, Cooling	WRS-C-023
24.	Hose, Tank Atmospheric Vent/Overflow, blue	WR105101
25.	Hose, Sterilizer #1 Drain, blue	WR105201
26.	Hose, Sterilizer #2 Drain, blue	WR105301
27.	Hose, Pump Discharge solenoid #3 to Cooling Coil, blue	WR105401
28.	Hose, Pump Discharge solenoid #1 to Sterilizer #1 return, blue	WR105501
29.	Hose, Water Tank Fill/Drain, blue	WR105601
30.	Hose, Cooling Coil Outlet to Tank, blue	WR105701
31.	Hose, Pressure Safety Valve Discharge to tank, blue	WR105801

Item	Description	Part No.
32.	Hose, Pump Suction from tank, blue	WR105901
33.	Hose, Pump Discharge solenoid #2 to Sterilizer #2 return, blue	WR105001
34.	Hose, Exhaust, 2151 to WRS, braided stainless steel with firesleeve	WR105111
35.	Hose, Return, WRS to 2151, braided stainless steel, w/o firesleeve	WR105112
36.	Cap, Hydraulic, for exhaust and return ports (with safety chain)	WR105113
37.	Wiring Harness, Motor	WRS-C-001
38.	Wiring Harness, Control Panel	WRS-C-002
39.	Wiring Harness, Solenoid Valve	WRS-C-003
40.	Wiring Harness, Temperature Switch	WRS-C-004
41.	Wiring Harness, Level Switch	WRS-C-005
42.	Cord, Electrical	WRS-C-006
43.	Receptacle, Power (mounted in control panel)	WRS-C-007

Appendix F

Instructions for Connecting the Water Recovery System (WRS) to the 2151 Steam Sterilizer

Instructions for Connecting the Water Recovery System (WRS) to the 2151 Steam Sterilizer

1-1. SCOPE:

a. Step by step procedure for connecting the WRS to the 2151 Sterilizer.

b. Equipment Needed: 2151 WRS Adaptor Kit, 2151 Sterilizer, and WRS

c. Purpose of Equipment: The 2151 WRS Adaptor Kit modifies the Sterilizer, Surgical Instrument and Dressing, Pressure, Steam, Electric or Gasoline Burner Heated, Corrosion Resting Metal, NSN 6530-00-926-2151, (hereafter referred to as the 2151) so that exhaust can be collected, condensed and returned to the 2151 by the WRS.

d. Components of the 2151 WRS Adaptor Kit (Qty=1 of each). See Figure F-1 on next page.

1. Exhaust Hose
2. Return Hose
3. Operating Valve Hose
4. Garden Hose
5. Steam Collection Assembly
6. Electrical Cord
7. Return Connector
8. Operating Valve Hose Adapter
9. Pipe Plug
10. Teflon Tape

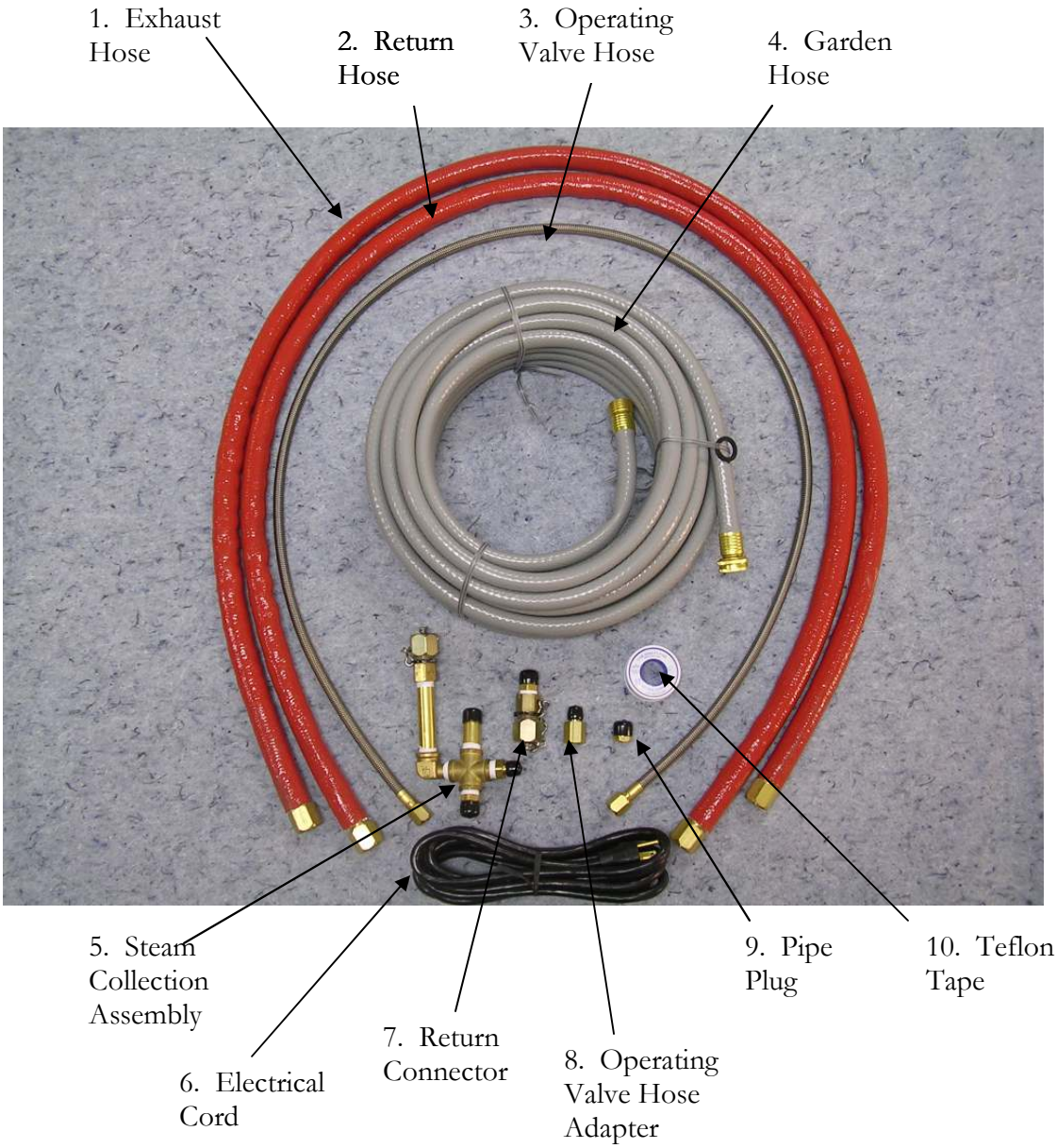


Figure F-1: Components of the 2151 WRS Adapter Kit

e. Tools needed to install the 2151 WRS Adapter Kit:

1. 11/16" opened end wrench
2. 3/4" opened end wrench
3. 7/8" opened end wrench
4. 1" opened end wrench
5. 1-1/8" opened end wrench or large crescent wrench
6. Pipe wrench
7. Medium-sized Phillips screwdriver

1-2. OPERATING PRINCIPLES. Once the 2151 WRS Adaptor Kit has been installed, the operating principles are as follows:

a. Steam exhausted from the 2151 operating valve and steam trap flows to the steam collection assembly, through the exhaust hose, and into the WRS, where it is condensed into water.

b. Water is returned to the 2151 through the return hose via the 2151 return connector installed in the boiler (near the heating assembly).

2-1. INSTALLATION OF 2151 WRS ADAPTOR KIT:

a. Preparation of the 2151: Disconnect the electrical power and drain the 2151 (see 2151 Operator's Manual).

b. <u>Staging the WRS:</u> Slide the WRS underneath the 2151 and between the support legs (Figure F-2). If a second 2151 is used, it should be placed on the left side of the first 2151 (when the operator is facing the first 2151 controls) so the operator will have access to the WRS controls.

Figure F-2: Staging the WRS Underneath the 2151

c. Steam Trap Assembly Removal: On the bottom front of the 2151, loosen the union nut on the inlet to the Steam Trap until it disengages from the threads on the steam trap. Remove the two ¼"-20 screws from the bottom of the 2151, and lift out the seam trap assembly. (Figure F-3).

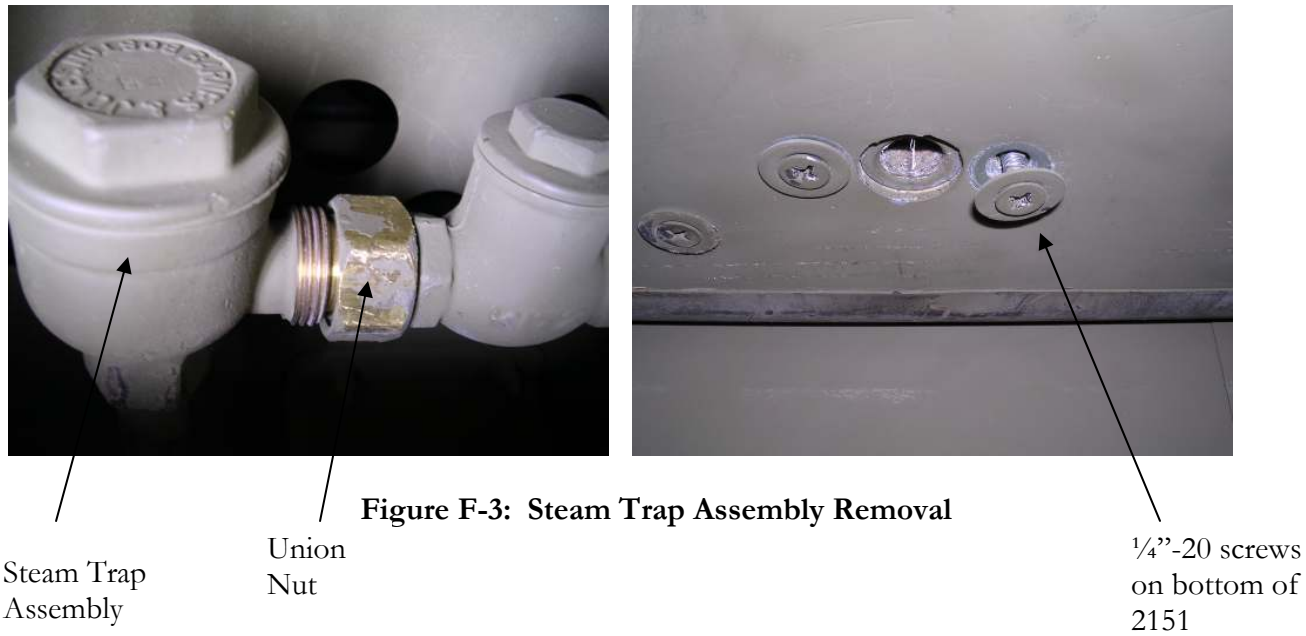


Figure F-3: Steam Trap Assembly Removal

c. Steam Trap Disassembly: Unscrew the pipe support, pipe nipple, and steam trap from each other (Figure F-4).

Figure F-4: Steam Trap Disassembly

d. Application of Teflon Tape: Apply Teflon tape to both 3/8" pipe nipples of the Steam Collection Assembly (top and bottom). Apply Teflon tape starting at the third thread from the end (skip the first two) and wind clockwise (Figure F-5).

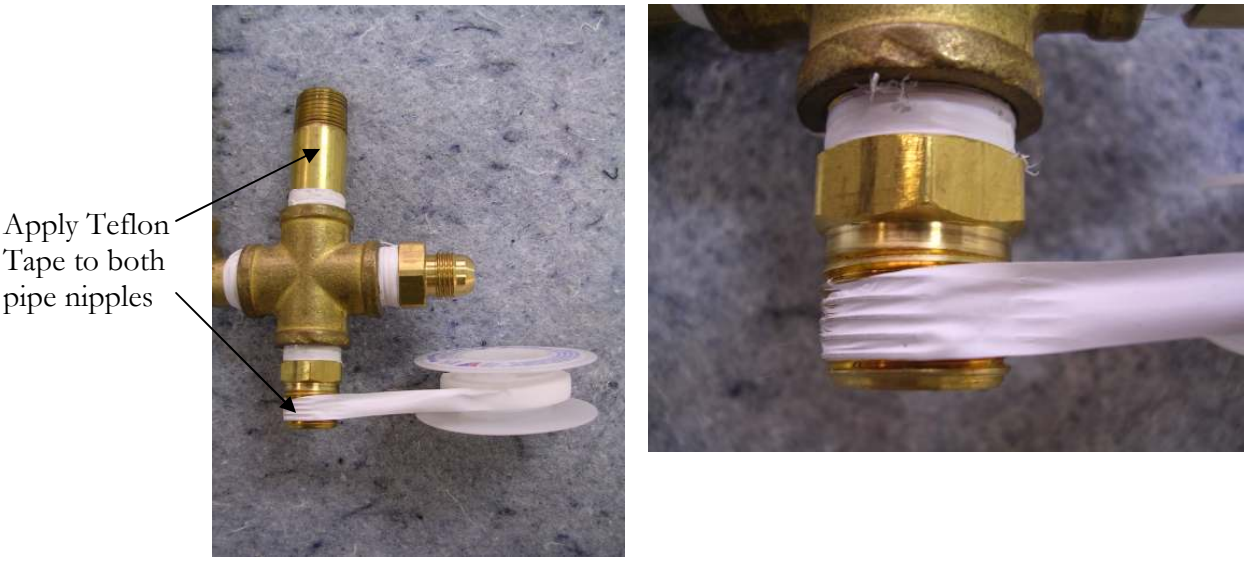


Figure F-5: Teflon Tape Application

e. Steam Trap Mounting: Tighten the Steam Trap to the top of the Steam Collection Assembly. Tighten the Pipe Support to the bottom of the Steam Collection Assembly. Tighten just the right amount to ensure an accurate height so that the assembly will mount to the floor of the 2151 and also fit-up properly to the steam trap inlet piping. Be sure to rotate the steam trap and the pipe support as shown to mate up properly with holes on the bottom and the inlet piping (Figure F-6).

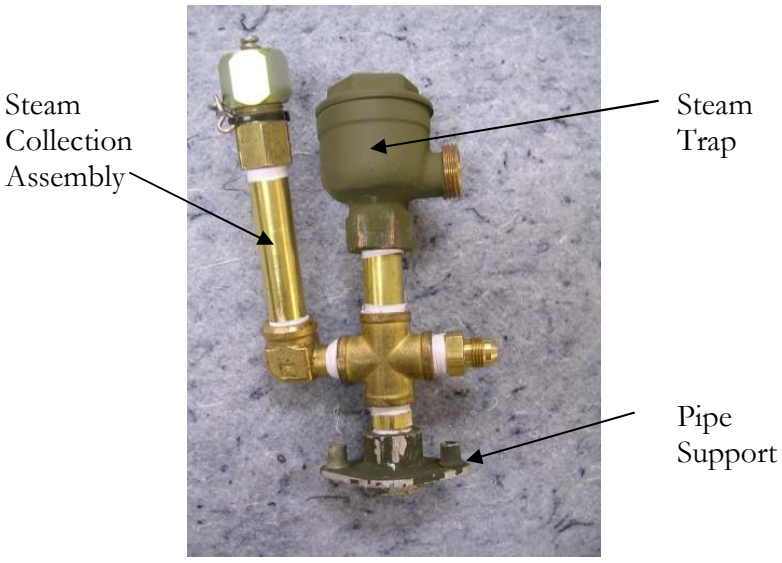


Figure F-6: Steam Trap Mounting

f. Operating Valve Hose Attachment: Tighten one end of the stainless steel Operating Valve Hose (uninsulated) to the new Steam Trap Assembly (Figure F-7).

Figure F-7: Attaching Operating Valve Hose to Stream Trap Assembly

g. Steam Trap Assembly Installation: Reattach the pipe support to the 2151 floor using the two ¼"-20 screws removed earlier. Attach the steam trap inlet pipe to the steam trap and tighten the union nut. Apply Teflon tape to the pipe plug and insert the plug into bottom of pipe support, inserting it through the floor of the 2151. (Figure F-8).

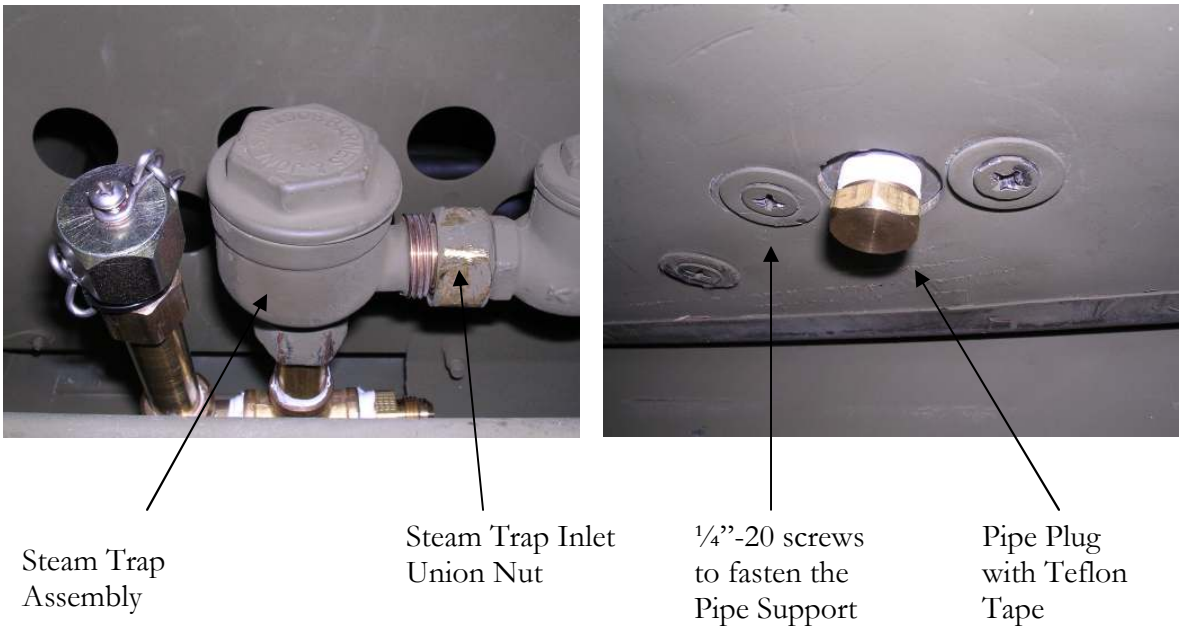


Figure F-8: Steam Trap Assembly Installation

h. Operating Valve Modifications: The Operating Valve is located on the top of the 2151. Loosen the Vent Tube Nut and move Vent Tube to the side (Figure F-8).

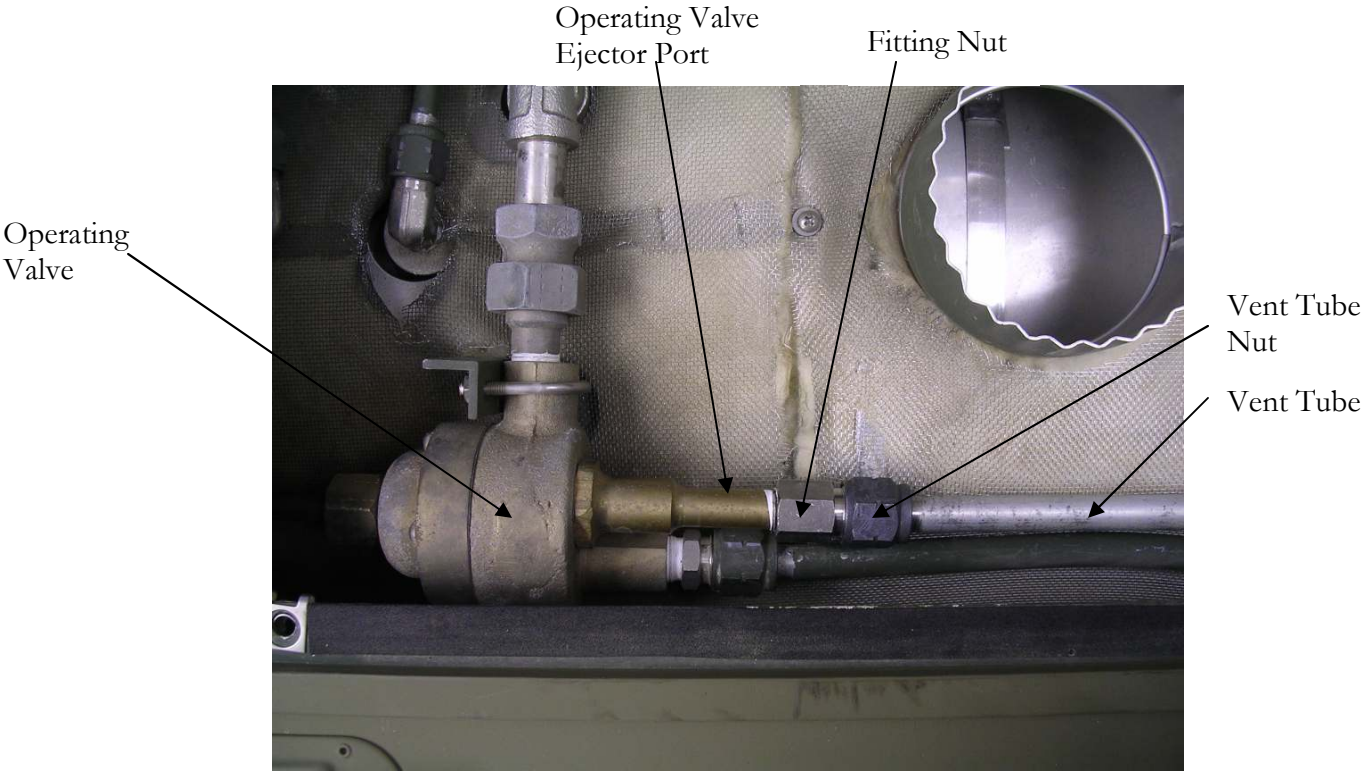


Figure F-8: Vent Tube Disconnection

i. Operating Valve Fitting Nut: Remove the Fitting Nut from the Operating Valve Ejector Port and apply Teflon tape to the pipe threads on the port. (Figures F-8 and F-9)

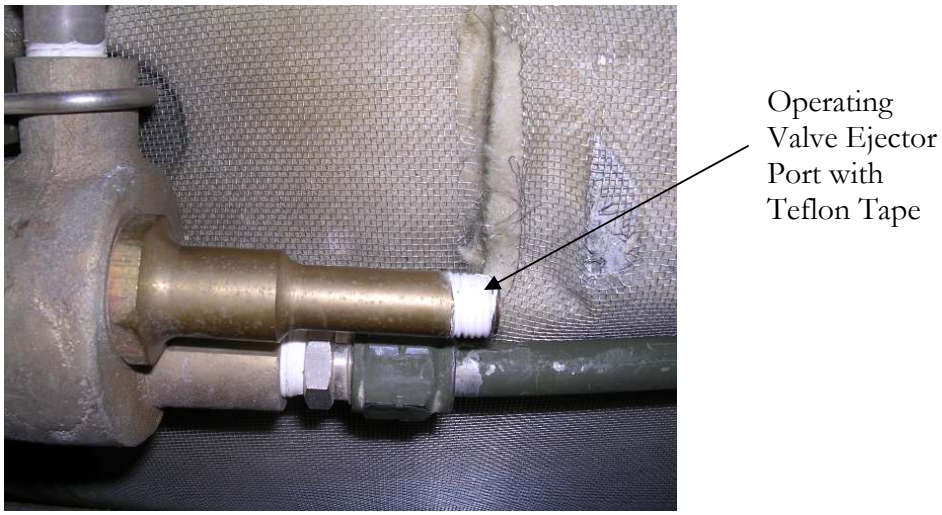


Figure F-9: Fitting Nut Removed and Teflon Tape on Ejector Port

j. Operating Valve Hose Adapter Installation: Thread the Operating Valve Hose Adaptor onto the Operating Valve Ejector Port and tighten (Figure F-10).

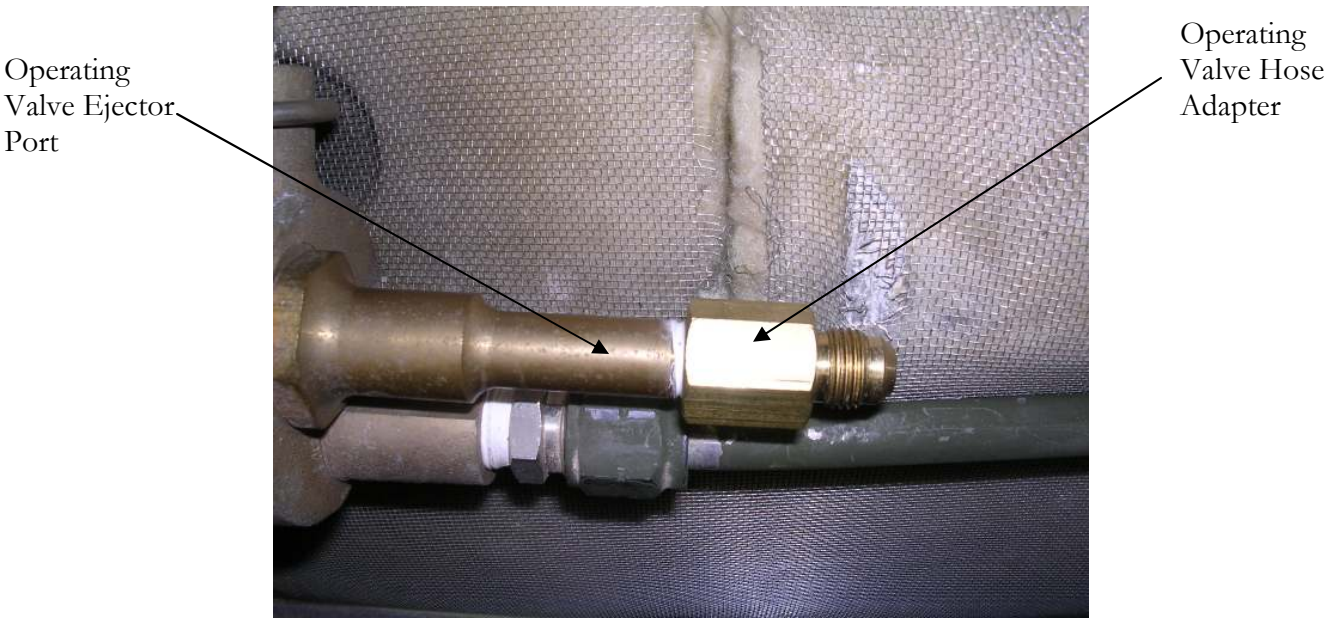


Figure F-10: Operating Valve Hose Adapter

k. Routing the Operating Valve Hose: Route the Operating Valve Hose through the front upper right corner of the 2151, and then loop around to connect to the Operating Valve Hose Adapter (Figure F-11). In order to fit the brass fitting of the hose through the corner opening, some metal may need to be filed away from the corner of the 2151.

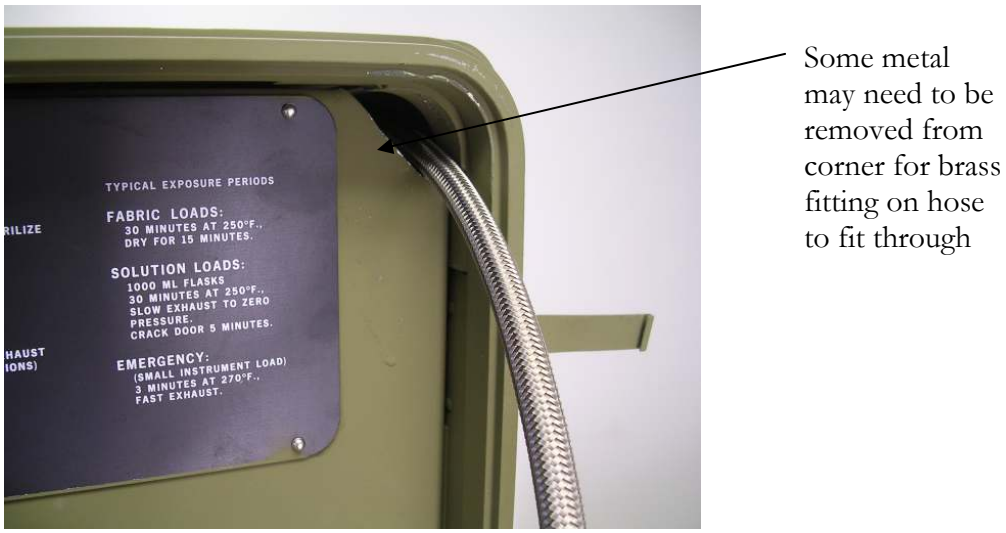


Figure F-11: Routing the Operating Valve Hose

l. Operating Valve Hose Connection: Tighten the flare nut on the Operating Valve Hose to the Operating Valve Hose Adaptor (Figure F-12).

Figure F-12: Operating Valve Hose Installation

m. Exhaust Hose Attachment to 2151: Remove the hydraulic cap from the Steam Trap Assembly, and tighten the Exhaust Hose onto this fitting (Figure F-13).

Figure F-13: Exhaust Hose Attachment

n. Exhaust Hose Attachment to WRS: Tighten the other end of the Exhaust Hose to the WRS inlet port labeled "Condensate from Sterilizer" (Figure F-14). (CAUTION: if two sterilizers are connected to the WRS, be sure that the hose is connected to the correct port on the WRS – either Sterilizer #1 or #2.)

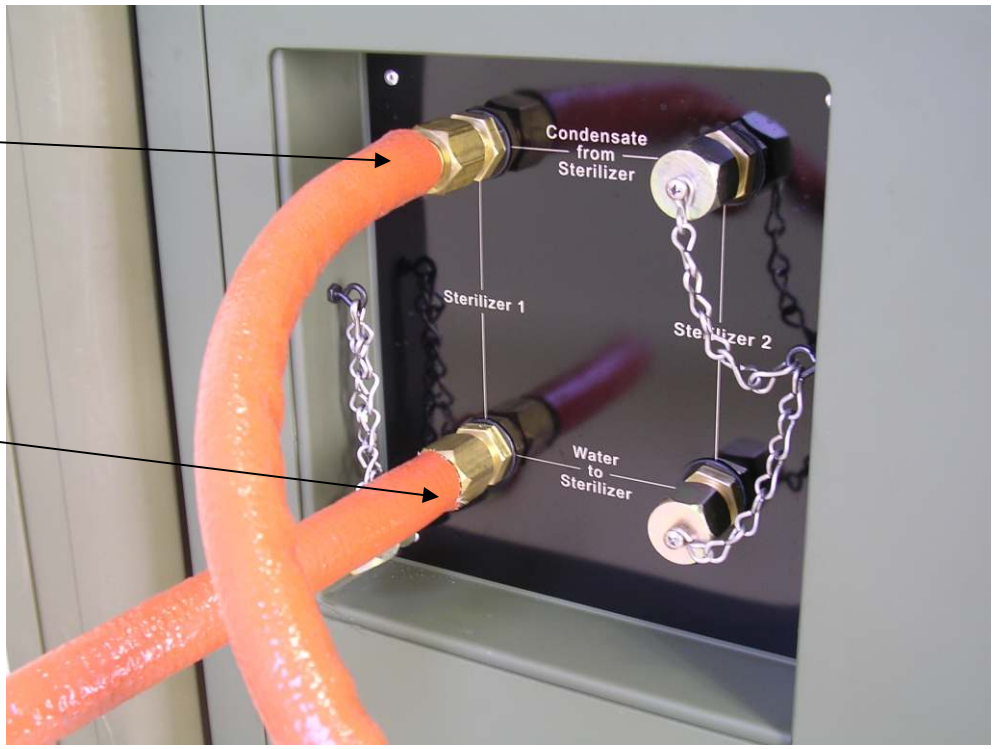

Exhaust Hose connected to the "Condensate from Sterilizer" port on WRS
Return Hose connected to the "Water to Sterilizer" port on WRS (reference step "p")
Condensate from Sterilizer
Sterilizer 1
Water to Sterilizer

Figure F-14: Exhaust and Return Hose Connections to WRS

o. Return Connector Installation: Facing the back of the 2151, locate the left hex head pipe plug underneath the heater assembly (Figure F-15). Remove this pipe plug from the boiler port. Apply Teflon tape to the Return Connector threads. Thread the return connector into the boiler port and tighten.

Figure F-15: Installation of Return Connector.

p. Attachment of Return Hose: Remove the hydraulic cap from the Return Connector, and Attach the Return Hose to the Return Connector (Figure F-16). Attach the other end of Return Hose to the WRS (see Figure F-14).

Figure F-16: Attachment of Return Hose to Return Connectyor

q. Attachment of Garden Hose: Attach the Garden Hose to the Drain/Fill Connection on the front of the WRS (Figure F-17). This hose can be used to fill the WRS and ultimately the 2151 (see WRS Technical Manual).

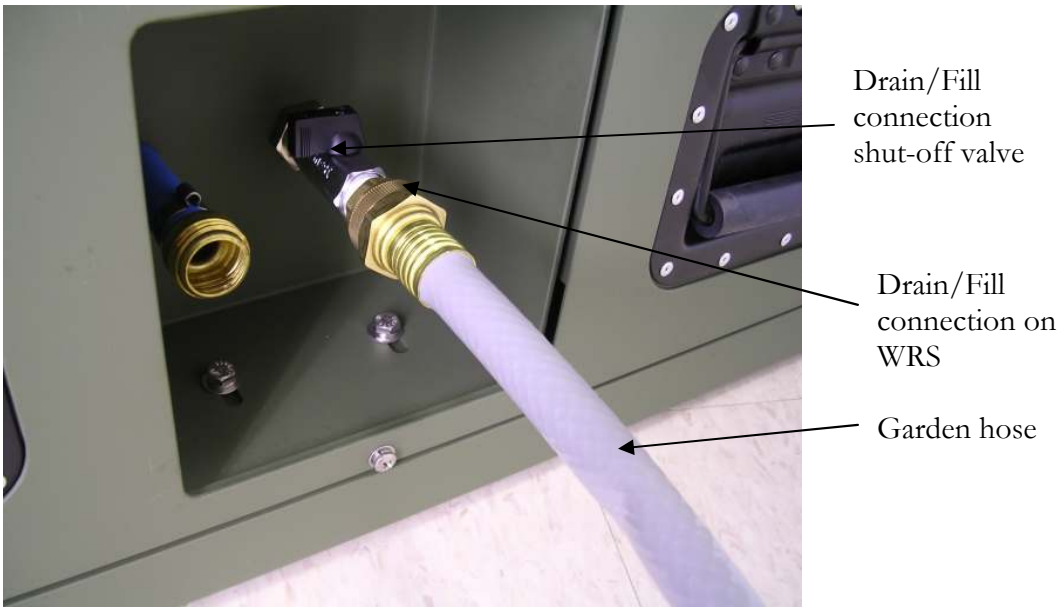


Figure F-17: Attachment of Garden Hose to Fill/Drain Connection

r. Connection of Electrical Cord: Ensure the Power Switch on the WRS is turned off. Connect the Electrical Cord to the plug on the operator control panel of the WRS (Figure F-18). Connect the other end of the Electrical Cord to a 115/120V power source.

If the power source is 208-240 Volts, see the WRS Technical Manual on how to easily change unit setup. WARNING: Failure to follow this procedure for 240 Volts 50 Hz could severely damage the WRS electrical system (Figure F-19).

Figure F-18: Connection of Electrical Cord to WRS

Figure F-19: Warning Label for 240 Volt 50 Hz Electrical Connection

s. Check for Water Leaks: Fill the WRS according to WRS Technical Manual. Follow the WRS and 2151operating procedures to operate the unit and inspect for leaks. Tighten any connections that may be leaking.

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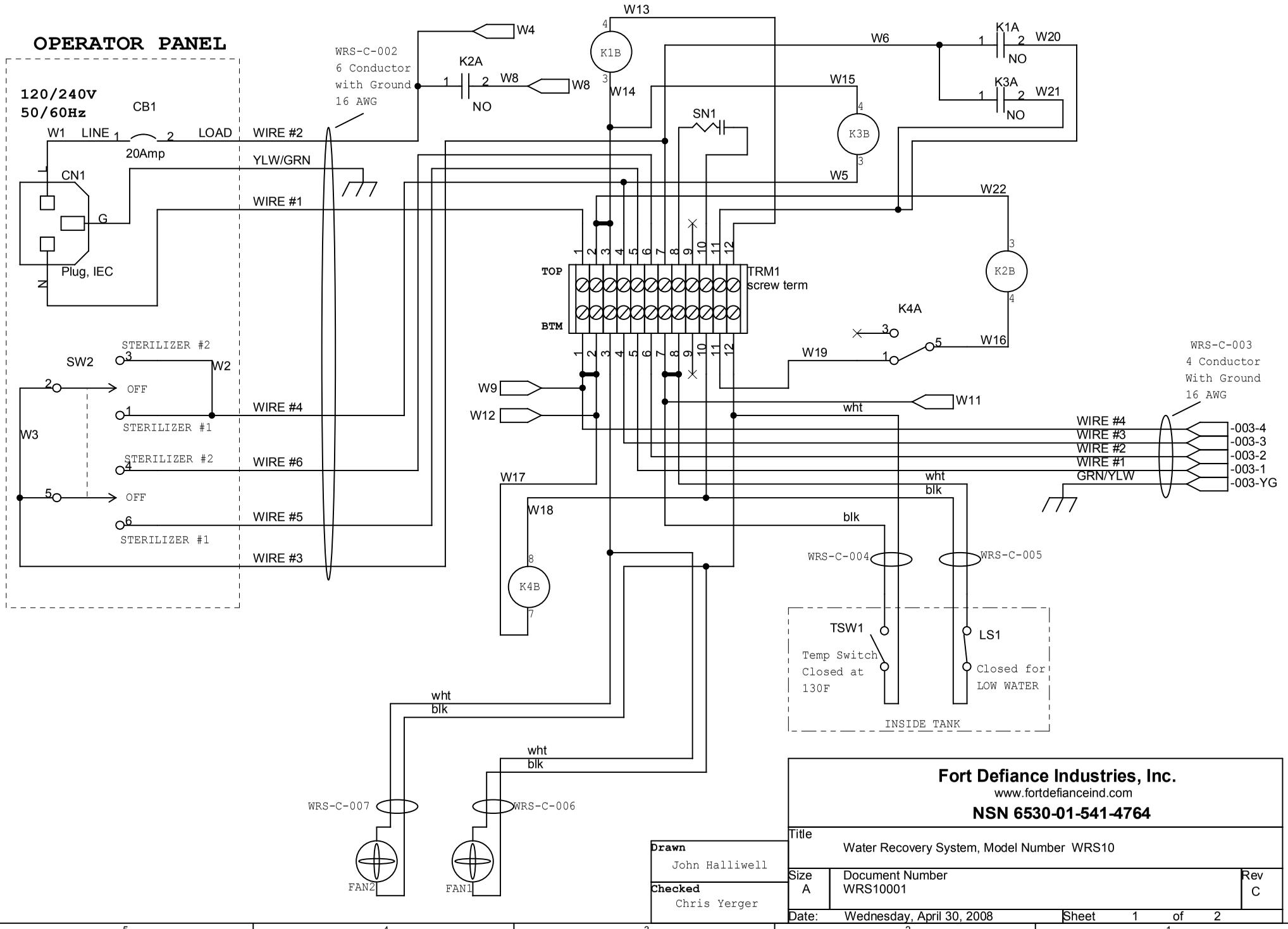
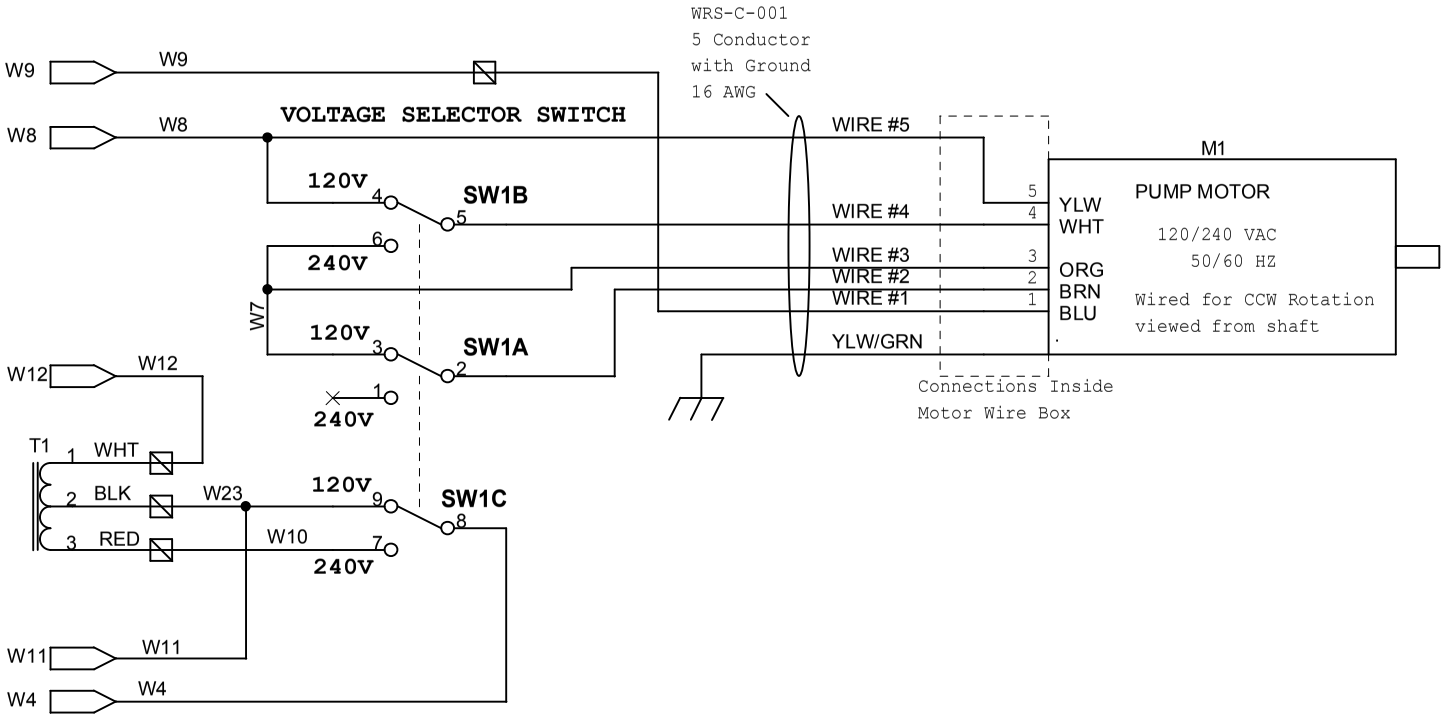
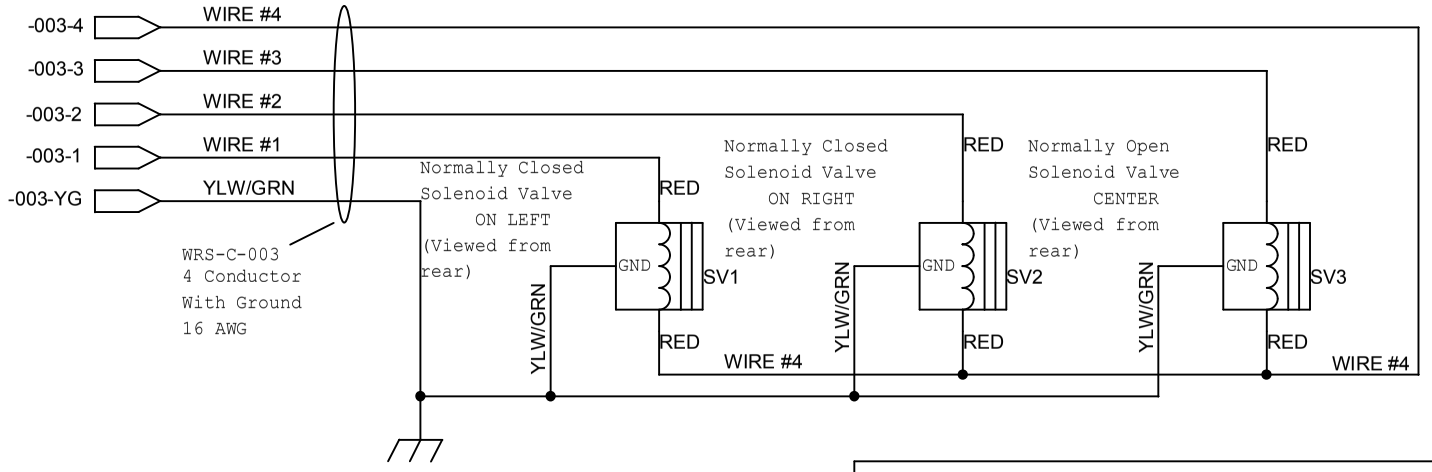


Fort Defiance Industries, Inc.	
www.fortdefianceind.com	
NSN 6530-01-541-4764	
Title	Water Recovery System, Model Number WRS10
Drawn: John Halliwell	Size: A; Document Number: WRS10001; Rev: C
Checked: Chris Yerger	Date: Wednesday, April 30, 2008; Sheet 1 of 2





Note: Indicates Wire Splice

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www.fortdefianceind.com
NSN 6530-01-541-4764

Drawn: John Halliwell	Title: Water Recovery System, Model Number WRS10	
Checked: Chris Yerger	Size: A	Document Number: WRS10001 — Rev: C
	Date: Wednesday, April 30, 2008	Sheet 2 of 2

Please read and save this Repair Parts Manual. Read this manual and the General Operating Instructions carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. The Safety Instructions are contained in the General Operating Instructions. Failure to comply with the safety instructions accompanying this product could result in personal injury and/or property damage! Retain instructions for future reference.

SHERTECH® Close-Coupled Turbine Pumps

Bronze and Cast Iron Models

Refer to form L-4077 for General Operating and Safety Instructions and Applicable Warranty.

Description

Shertech regenerative turbine pumps use impellers with many closely spaced blades to provide pressures to 130 PSI and up to 9 GPM. There is no metal-to-metal contact and pumps can handle liquids with entrapped air without vapor locking. Turbine pumps are used in many industrial and commercial applications such as boiler feed on steam process, condensation return, pressure booster service, water treatment, spray equipment, reverse osmosis filtration equipment and liquid transfer where no suction lift is required. Maximum liquid temperature is 160° F; minimum temperature is 40° F. Maximum viscosity is 100 SSU.

Corrosive (non-saline), abrasive or highly viscous liquids, or liquids with particles in suspension, should not be pumped with a turbine design pump. The Cast Iron models are suitable for general service with non-corrosive and nonflammable fluids and the Bronze models are designed for use with saltwater brine and other nonflammable liquids. Both Bronze and Cast Iron models have a bronze impeller and bronze shaft sleeve, mechanical seal with carbon on ceramic, and Buna-N construction is standard. An optional Viton mechanical seal is available (see parts table). The wetted surfaces on Cast Iron component models are nickel-plated for enhanced corrosion resistance.

Pumps are close-coupled to AC NEMA 56J frame, 3/4 - 1½ hp, 3450 RPM, ball bearing motors. Single-phase units have capacitor start, open drip-proof (ODP) motors with thermal overload protection. Three-phase units have totally enclosed fan cooled (TEFC) motors. Overload protection is not supplied on three-phase units and must be provided in starter units. Pump control box must be ordered separately.

REPAIR SEALS AND OPTIONS – Standard (Buna-N) and an upgraded (Viton) seal are available. Standard and upgraded seals are called out in the repair parts list pages in this manual.

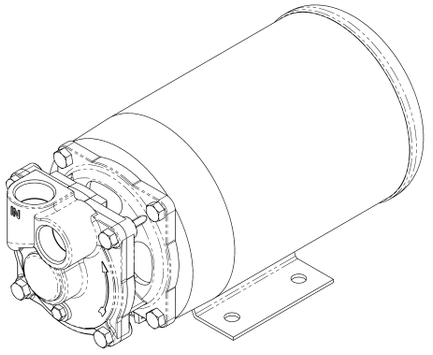
PUMP HEADS AND PEDESTAL MOUNT BASE – Complete pump heads and pedestal base can be ordered. Pump head and pedestal model numbers are called out in the repair parts list pages in this manual.

Do not use to pump flammable or explosive fluids such as gasoline, fuel oil, kerosene, etc. Do not use in flammable and/or explosive atmospheres. When pumping hazardous or dangerous materials, use only in room or area designated for that purpose. For your protection, always wear proper clothing, eye protection, etc. in case of any malfunction. For proper handling techniques and cautions, contact your chemical supplier, insurance company and local agencies (fire dept., etc.). Failure to comply with this warning could result in personal injury and/or property damage.

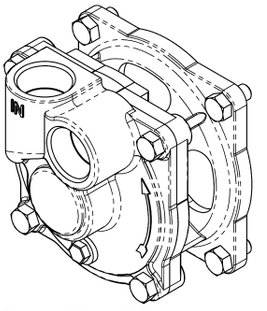
⚠ CAUTION ***This pump is not suitable to be used pumping liquids that contain dirt, particles, shavings, chips, etc. The close tolerances of the impeller and housing will cause these particles to jam pump/motor. Failure to follow this warning can cause pump/motor to fail, which can result in property damage and/or personal injury and will void the product warranty.***

SHERTECH® Close-Coupled Turbine Pumps
Bronze and Cast Iron Models

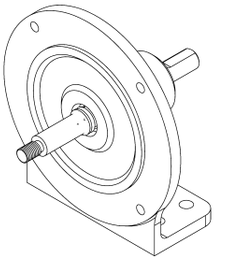
Model Ordering Codes and Options



M: Motor (with base)



Pump Head Kit



P: Pedestal Mount

Example Model: TXMBB13 (3/4 HP ODP motor with >1.15 Service Factor*)

(1) TX	(2) M	(3) B	(4) B	(5) 1	(6) 3	(7)

1st	2nd	3rd	4th	5th	6th	7th
Series	**Mounting**	**Material**	**Seal** (Mech)**	**Impeller Sz. (NPT Ports)**	**Motor-Mounted Only**	
					HP	**AC Type**
TX: Turbine	M: Motor (with Base) P: Pedestal	B: Bronze (Bronze Impeller) C: Cast Iron (Bronze Impeller)	B: Buna-N (Stainless Steel Components) V: Viton (Stainless Steel Components)	1 (1" NPT) 2 (1" NPT) *To identify your impeller size, see chart on page 12.*	2: 1/2 3: 3/4 4: 1 5: 1½ 6: 2 X: 56J Frame motor "wet end kit"	Blank: no code single phase ODP motor 3: 3 phase ODP motor T: 1 phase TEFC 3T: 3 phase TEFC

NOTE: Not all order code combinations (configurations) are standard models available from the manufacturer. Custom model configurations may require ordering standard components and/or optional parts that will need to be assembled by the customer.

Manufacturer reserves the right to change model order codes, standard models, specifications, and performance without notification.

(*) ODP motors have > 1.15 service factors. Due to service factor, it is recommended TEFC motors are oversized by one HP increment. Pedestal Pumps are not supplied with a motor.

(**) Unless otherwise noted, seal faces are carbon on ceramic.

Bronze and Cast Iron Models

Performance – Standard Models (Water at 70°)

Model	Max. GPM**	GPM at total pressure (in PSI)* 10	20	40	60	80	100	120	Max. PSI
Bronze Models									
TXMBBX	5.6	5.2	4.9	4.3	3.8	3.3	2.8	2.2	120
TXMBB13	5.6	5.2	4.9	4.3	3.8	3.3	2.8	2.2	120
TXMBB133T	5.6	5.2	4.9	4.3	3.8	3.3	2.8	2.2	120
TXMBB2X	9	8.9	8.7	8.1	7.2	6.3	5.3	4.3	130
TXMBB25	9	8.9	8.7	8.1	7.2	6.3	5.3	4.3	130
TXMBB253T	9	8.9	8.7	8.1	7.2	6.3	5.3	4.3	130
Cast Iron Models									
TXMBC13	5.6	5.2	4.9	4.3	3.8	3.3	2.8	2.2	120
TXMBC1X	5.6	5.2	4.9	4.3	3.8	3.3	2.8	2.2	120
TXMBC133T	5.6	5.2	4.9	4.3	3.8	3.3	2.8	2.2	120
TXMBC2X	9	8.9	8.7	8.1	7.2	6.3	5.3	4.3	130
TXMBC25	9	8.9	8.7	8.1	7.2	6.3	5.3	4.3	130
TXMBC253T	9	8.9	8.7	8.1	7.2	6.3	5.3	4.3	130

(*) Test data is taken with water at 70°F for pumps with 60 Hz motors at 3450 RPM motors (to convert data to PSI, divide feet of head by 2.31). Pump performance when pump is new. As pump wears, the performance will decrease.
(**) Intake at top of pump. With 1 PSI, positive suction head (flooded suction).

NOTES: A suitable relief valve, should be installed to ensure that maximum PSI is not exceeded. Otherwise, electric motor may be overloaded.
Maximum Viscosity = 100 SSU
Maximum Specific Gravity = 1.1
Maximum Torque = 65 in.-lbs.
Maximum Speed = 3600 RPM
Manufacturer reserves the right to change performance without notification.

Specifications – Standard Models

	DRIVER										PUMP CONSTRUCTION (Wet End)					
Pump Model	HP	AC Motor Type	NEMA Frame	Motor Voltage	Full Load Amps	Serv. Factor Amps	Hertz	Phase	RPM	Overload Protection	Port Size NPT	Shaft	Cover & Body	Impeller	Seals*	Ship Wt. (lbs.)
Bronze Models																
TXMBB1X	3/4	-	56J	-	-	-	-	-	3450	-	1" x 1"	Bronze	Bronze	Bronze	Buna-N	14
TXMBB13	3/4	ODP	56J	115/230	9.8/4.8-4.9	13.2/6.4-6.6	60	1	3450	Yes	1" x 1"	Bronze	Bronze	Bronze	Buna-N	32
TXMBB133T	3/4	TEFC	56J	208-220/440	3-3.2/1.6	3.1-3.3/1.65	50/60	3	3450	No	1" x 1"	Bronze	Bronze	Bronze	Buna-N	38
TXMBB2X	1½	-	56J	-	-	-	-	-	3450	-	1" x 1"	Bronze	Bronze	Bronze	Buna-N	16
TXMBB25	1½	ODP	56J	115/230	13.4/7.4-6.7	17.6/10.3-8.8	60	1	3450	Yes	1" x 1"	Bronze	Bronze	Bronze	Buna-N	40
TXMBB253T	1½	TEFC	56J	208-220/440	4.7-4.6/2.3	4.9-5.0/2.5	50/60	3	3450	No	1" x 1"	Bronze	Bronze	Bronze	Buna-N	43
Cast Iron Models																
TXMCBX	3/4	-	56J	-	-	-	-	-	3450	-	1" x 1"	Bronze	Cast Iron	Bronze	Buna-N	12
TXMCB13	3/4	ODP	56J	115/230	9.8/4.8-4.9	13.2/6.4-6.6	60	1	3450	Yes	1" x 1"	Bronze	Cast Iron	Bronze	Buna-N	30
TXMCB133T	3/4	TEFC	56J	208-230/460	3-3.2/1.6	3.1-3.3/1.65	50/60	3	3450	No	1" x 1"	Bronze	Cast Iron	Bronze	Buna-N	36
TXMCB2X	1½	-	56J	-	-	-	-	-	3450	-	1" x 1"	Bronze	Cast Iron	Bronze	Buna-N	14
TXMCB25	1½	ODP	56J	115/230	13.4/7.4-6.7	17.6/10.3-8.8	60	1	3450	Yes	1" x 1"	Bronze	Cast Iron	Bronze	Buna-N	38
TXMCB253T	1½	TEFC	56J	208-230/460	4.7-4.6/2.3	4.9-5.0/2.5	50/60	3	3450	No	1" x 1"	Bronze	Cast Iron	Bronze	Buna-N	41

ODP = Open Drip Proof TEFC = Totally Enclosed Fan Cooled
(*) Shaft Seal also contains stainless steel, ceramic, and carbon components.

NOTES: Driver data is subject to change without notice; see label on driver for actual information.
Manufacturer reserves the right to change specifications without notification.

SHERTECH® Close-Coupled Turbine Pumps
Bronze and Cast Iron Models

Dimensions (Inches)

Motor Length Dimensions

Model	A†	Z†
TMBB13, TMCB13	8.88	6.50
TMBB25, TMCB25	9.87	6.50
TMBB133T, TMCB133T	9.75	7.36
TMBB253T, TMCB253T	9.75	7.36

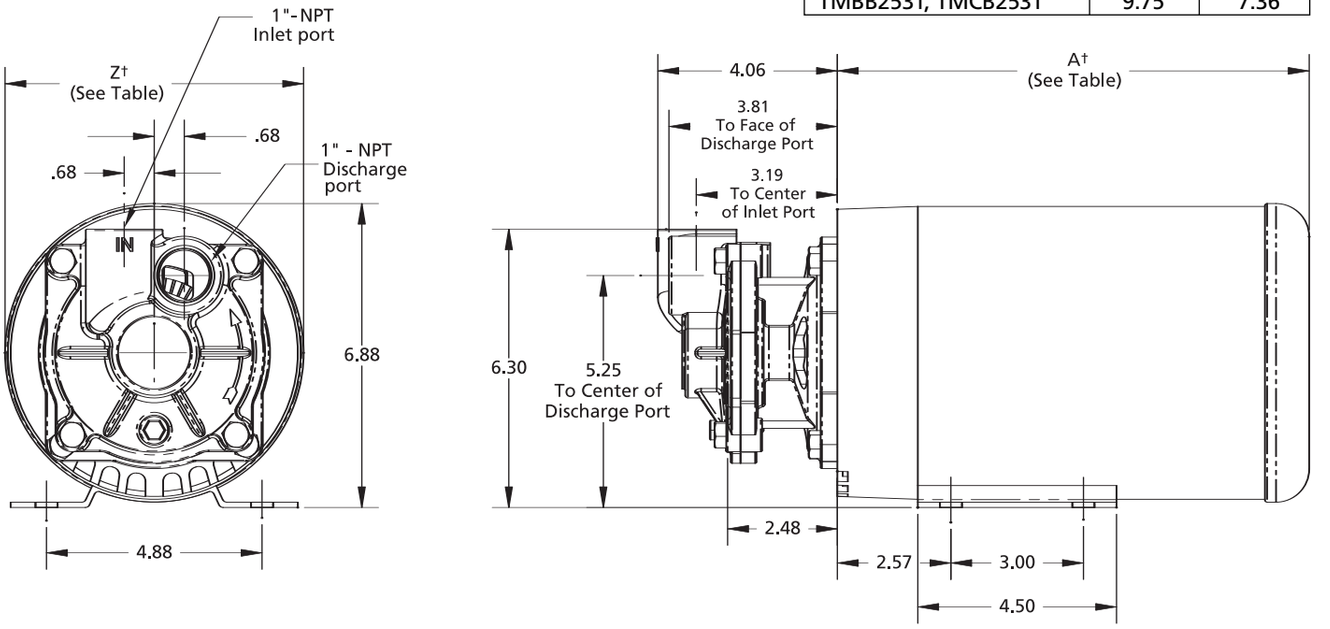


Figure 1 – Dimensions

NOTE: All dimensions have a tolerance of ± 1/8".
(†) This dimension may vary due to motor manufacturer's specifications.
NOTE: Motor driver is subject to change without notice.

(Optional) Pedestal Pump Mount Part Number 24479 (Replaces 56J frame motor) (When long coupling or pulley drive is required)

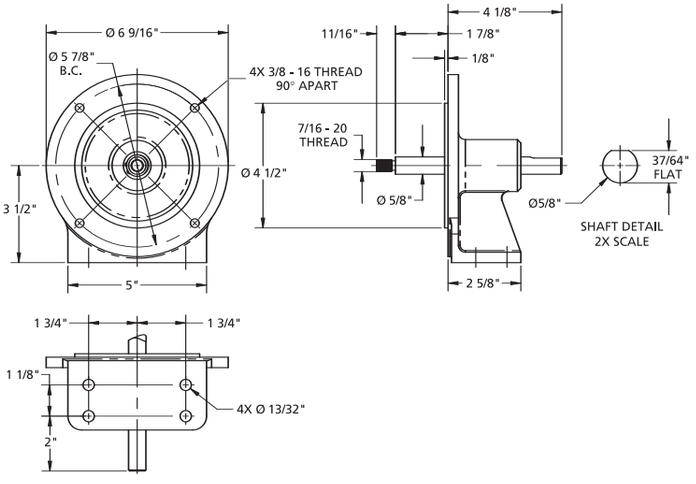


Figure 5

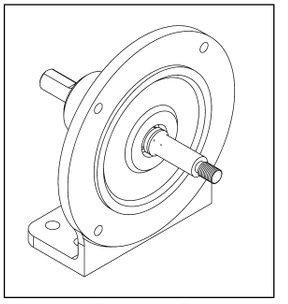
NOTE: Dimensions have a tolerance of ± 1/8".
(Ø) Diameter.

Contact a Shertech Distributor

Distributors can be found at www.shertech.com or www.hyproindustrial.com

(The factory only sells pumps and parts to distributors.)

Please provide following information:
-Model number
-Serial number (if any)
-Part description and number
as shown in parts list



Optional Pedestal Base

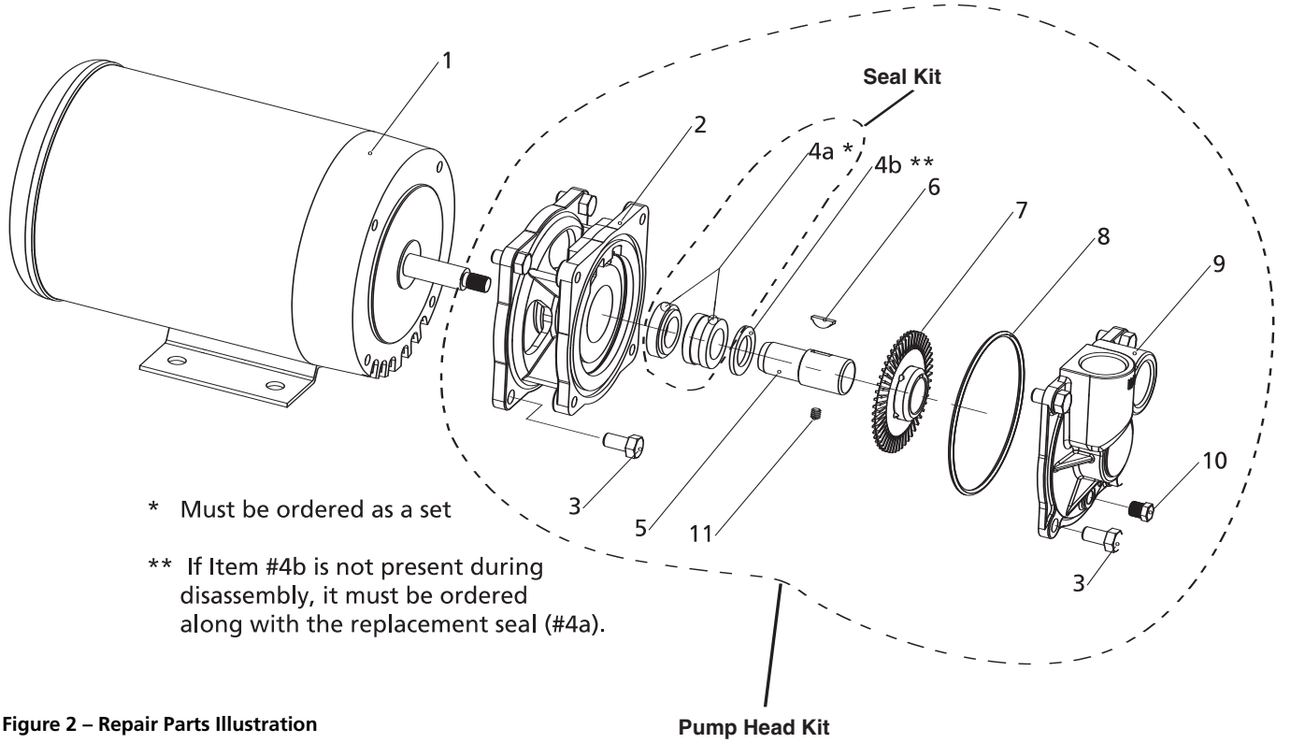


Figure 2 – Repair Parts Illustration

SHERTECH® Close-Coupled Turbine Pumps

Bronze and Cast Iron Models

Repair Parts List for Bronze Models

Ref. No.	Description	Part No. for Models: TXMBBX	TXMBB13	TXMBB25	TXMBB2X	TXMBB133T	TXMBB253T	Qty.
1	Motor Assembly**	14012H	14012H	14014H	14014H	14017H	14018H	1
2	Bronze Body	13764	13764	13765	13765	13764	13765	1
3	3/8-16 x 3/4" SS Hex head screw (SS)	11633	11633	11633	11633	11633	11633	8
4a	Mechanical Seal, Standard - Carbon/ceramic seats, SS and Buna-N parts	24458S	24458S	24458S	24458S	24458S	24458S	1
	Mechanical Seal, Optional - Carbon/ceramic seats, SS and Viton parts	24457S	24457S	24457S	24457S	24457S	24457S	1
4b	Seal Collar (Bronze)*	17681	17681	17681	17681	17681	17681	1
5	Shaft Sleeve (includes set screw - Ref. #11)	13768	13768	13768	13768	13768	13768	1
6	Key	13777	13777	13777	13777	13777	13777	1
7	Impeller (Bronze)	13769	13769	13770	13770	13769	13770	1
8	O-ring gasket, Buna-N, Standard	13774	13774	13774	13774	13774	13774	1
	†O-ring gasket, Viton, Optional	18104	18104	18104	18104	18104	18104	1
9	Bronze Cover	13766	13766	13767	13767	13766	13767	1
10	Drain Plug (Brass)	00336	00336	00336	00336	00336	00336	1
11	1/4-20 x 1/2" Set Screw (Bronze)	13859	13859	13859	13859	13859	13859	1

* If Seal Collar is not present during disassembly, it must also be ordered along with the replacement seal.
** Motors come standard with slinger.

Repair Parts List for Cast Iron Models

Ref. No.	Description	Part No. for Models: TXMCBX	TXMCB13	TXMCB25	TXMCB2X	TXMCB133T	TXMCB253T	Qty.
1	Motor Assembly**	14012H	14012H	14014H	14014H	14017H	14018H	1
2	Cast Iron Body	24476	24476	24475	24475	24476	24475	1
3	3/8-16 x 3/4" SS Hex head screw (SS)	11633	11633	11633	11633	11633	11633	8
4a	Mechanical Seal, Standard - Carbon/ceramic seats, SS and Buna-N parts	24458S	24458S	24458S	24458S	24458S	24458S	1
	Mechanical Seal, Optional - Carbon/ceramic seats, SS and Viton parts	24457S	24457S	24457S	24457S	24457S	24457S	1
4b	Seal Collar (Bronze)*	17681	17681	17681	17681	17681	17681	1
5	Shaft Sleeve (includes set screw - Ref. #11)	13768	13768	13768	13768	13768	13768	1
6	Key	13777	13777	13777	13777	13777	13777	1
7	Impeller (Bronze)	13769	13769	13770	13770	13769	13770	1
8	O-ring gasket, Buna-N, Standard	13774	13774	13774	13774	13774	13774	1
	†O-ring gasket, Viton, Optional	18104	18104	18104	18104	18104	18104	1
9	Cast Iron Cover	24474	24474	24472	24472	24474	24472	1
10	Drain Plug (Steel)	23182	23182	23182	23182	23182	23182	1
11	1/4-20 x 1/2" Set Screw (Bronze)	13859	13859	13859	13859	13859	13859	1

* If Seal Collar is not present during disassembly, it must also be ordered along with the replacement seal.
** Motors come standard with slinger.

Complete Pump Heads	Bronze	Cast Iron
3/4 HP PUMP HEAD	TMBB1X	TMCB1X
1½ HP PUMP HEAD	TMBB2X	TMCB2X
(Optional) Pedestal Bracket w/ 316 SS shaft (Can be substituted for any 56J frame motor when a pulley drive or long coupled pump is desired [see figure 5])		24479

Bronze and Cast Iron Models

Installation

⚠ DANGER ***In any installations where property damage and/or personal injury might result from an inoperative or leaking pump due to power outages, discharge line blockages, or any other reason, a backup system(s) should be used.***

⚠ DANGER ***In order to safely use this product, familiarize yourself with this pump and also with the liquid (chemical, etc.) that is going to be pumped through the pump. This pump is not suitable for many liquids.***

1. Locate pump close to and below the liquid level supply so that there will always be a positive supply of fluid at the pump inlet (See Figure 3). If the pump is located above the liquid level, a positive sealing foot valve or check valve must be installed at the end of the suction line or in the piping just before the pump. Suction lifts over 10 ft. are not recommended.

NOTE: Unit should be placed where the motor and electrical components are protected from the weather and extremes of heat, cold and humidity.

2. Mount unit on a solid foundation and secure with appropriate fasteners.

⚠WARNING ***Support pump and piping when assembling and when installed. Failure to do so may cause piping to break, pump to fail, motor bearing failures, etc. all of which can result in property damage and/or personal injury.***

PIPING

SUCTION

Attach piping suction line to suction inlet and piping discharge line to discharge outlet. The suction piping line should be positioned such that there is a direct line from the fluid source to the pump; avoid using loops or other sections or pipe or fittings which might permit air to become trapped. Use a priming chamber if required.

IMPORTANT: If plastic or fabric hose is used for the suction piping, it should be of a reinforced type so as not to collapse under suction. The suction piping should be at least the same size as the inlet connection. Discharge piping should be the same size as the suction piping or one size smaller.

⚠ CAUTION ***See page 1 for unsuitability of this pump for pumping dirty liquids.***

DISCHARGE

Discharge piping (plumbing parts mentioned below not furnished). See Figure 3.

1. Install short nipple (3" to 12" long).
2. Install pipe tee on end of nipple.
3. Insert pipe plug into vertical leg of tee.
4. Install short nipple (3"), gate valve, short nipple (3") and union.
5. The remaining system components may be connected to this arrangement as required.

The purpose of the piping configuration is for priming (remove tee plug and fill with water), gate valve for regulating water demand, and union for servicing. Use of pipe union facilitates pump removal and installation.

NOTE: Do not use a globe or other restricting type of valve at the discharge. Globe valves seriously restrict the capacity of the pump.

Operation

1. Fill pump and suction piping with water.

NOTE: This turbine pump must be satisfactorily primed before it will pump. Satisfactory priming requires that all air must be removed from the pump and suction lines and that these areas be completely filled with liquid. This must be accomplished with the pump at a standstill.

2. Begin pumping operations as follows:

NOTE: Unit must be full of liquid to be pumped in order to cool and lubricate the seal surfaces. Do not run pump dry as permanent damage to mechanical seal will result.

⚠ CAUTION ***Clockwise rotation when facing pump inlet will destroy motor. Incorrect wiring is not covered under limited warranty.***

IMPORTANT: Power should be applied momentarily to the pump at first and the direction of rotation checked. When viewing unit from the front of the pump housing, impeller rotation should be counterclockwise. If it is not, disconnect power and recheck wiring to motor. To change rotation on a three-phase motor, interchange any two incoming power leads.

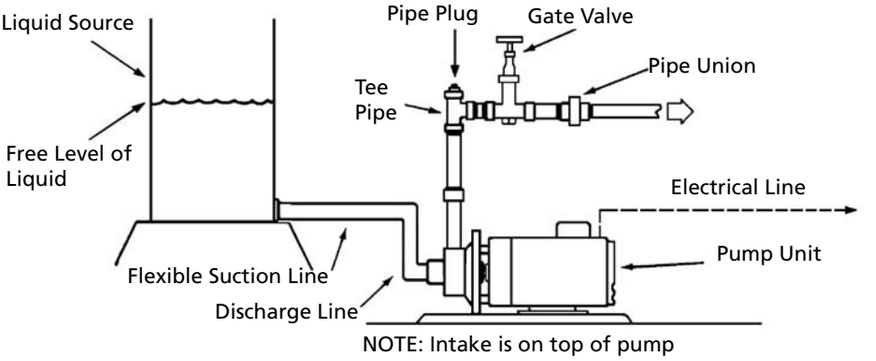


Figure 3 – Typical Installation

SHERTECH® Close-Coupled Turbine Pumps
Bronze and Cast Iron Models

Operation (Continued)

3. On initial start-up, check power consumption to be sure motor is not overloaded.

NOTE: Never shut off discharge or restrict suction flow while unit is operating.

Maintenance

⚠WARNING ***Electric disconnect should only be done by a qualified electrician. Note: This pump can be challenging to work on. Only qualified repair technicians should be used. Improper repair and/or assembly can cause damage to pump/motor and also create an electric shock hazard.***

GENERAL

1. Pump should be drained if subjected to freezing temperatures. A drain plug (Ref. No. 10) is provided on the pump casing.
2. Clean the suction line strainer at regular intervals.
3. Periodically clean dirt accumulations from open-type motors, especially in and around vent openings, preferably by vacuuming (avoids imbedding dirt in windings). Properly selected and installed electric motors are capable of operating for years with minimal maintenance.
4. Pump motor (Ref. No. 1) is provided with sealed ball bearings. Normal relubrication of the bearings is not required.
5. Periodically check that electrical connections are tight.
6. Pump should be checked daily, weekly, monthly, etc. for proper operation. If anything has changed since unit was new, unit should be removed and repaired or replaced. Only qualified electricians or technicians should attempt to repair this unit. Improper repair and/or assembly can cause an electrical shock hazard.

MECHANICAL SEAL

All Shertech pumps are furnished with a precision mechanical seal (Ref. No. 4). This seal is installed and checked at the factory and should require no adjustment at the time of the installation of the pump. Running the pump without water will result in rapid seal failure.

After the pump has been in service for a long period of time, or if the pump has seen severe service on abrasive materials, it may be necessary to replace this seal (the seal may leak). Leakage can be detected by a dripping or flow of liquid from the area around the motor shaft sleeve (Ref. No. 5).

⚠ CAUTION ***Precision lapped faces on the mechanical seal are easily damaged. Handle your replacement seal carefully and read these instructions before attempting to replace the seal.***

DISASSEMBLY OF PUMP

After the plumbing has been removed from the intake and discharge ports, the pump can be readily disassembled.

1. Remove the four 3/8" diameter bolts (Ref. No. 3) that attach to front cover (Ref. No. 9) of the body. Then remove the cover and o-ring gasket (Ref. No. 8).

⚠ CAUTION ***Care should be taken not to pinch or "shave" the o-ring gasket (Ref. No. 8) between the adapter and the casing.***

2. The impeller (Ref. No. 7) floats on the pump shaft sleeve (Ref. No. 5); therefore it can be readily removed (See Figure 4).
3. Loosen set screw (Ref. No. 11) on pump shaft sleeve (Ref. No. 5). The pump shaft sleeve is threaded on the motor shaft. Turn the pump shaft sleeve counterclockwise to remove (See Figure 4).

NOTE: It will be necessary to hold the motor shaft. A screwdriver slot or two flats for use with an open end 7/16" wrench are provided at the rear of the motor shaft (pry off cap for access). To prevent motor shaft from turning, either insert a larger screwdriver blade into the slot, or use a 7/16" wrench across the flats.

4. The seal (part of Ref. No. 4a) will come off with the shaft sleeve (Ref. No. 5) (See Figure 4).

⚠ CAUTION ***The precision carbon/ceramic faces on the mechanical seal are easily damaged. Handle your repair seal carefully. Do not touch the carbon/ceramic faces.***

5. Remove the pump body (Ref. No. 2) and push out the seal seat (part of Ref. No 4a) with a wooden dowel to remove the seal seat (See Figure 5).
6. Clearance between the impeller (Ref. No. 7), the body (Ref. No. 2) and the cover (Ref. No. 9) is held to a minimum for high pressure performance. Therefore, any wear in these parts due to pumping abrasives, etc., would affect the pump performance. Replace parts when necessary.
7. If it becomes necessary to replace the seal or seat, always replace them with a complete seal and seat assembly (Ref. No. 4a).
8. Inspect the pump to see if the collar shown in Figure 7 is present. The mechanical seal requires the use of the collar to set the proper seal working height. If the collar (Ref. No. 4b) is not present, order item #17681 when ordering the replacement seal.

ASSEMBLY OF PUMP

IMPORTANT: Be sure that shaft shoulder does not damage carbon face.

1. Thoroughly clean all surfaces of the seal seat cavity in adapter (Ref. No. 2).
2. Using a clean cloth, wipe the shaft

Bronze and Cast Iron Models

Maintenance (Continued)

and shaft sleeve and make certain that they are perfectly clean.

3. Wet the rubber portion of the new seal seat (part of Ref. No. 4a) with a light coating of soapy water. While wearing clean gloves or using a clean light rag, press seal seat squarely into adapter recess. Use the cardboard washer (usually supplied with new seal) to place over the polished ceramic surface and use a piece of pipe or dowel rod to press in firmly but gently (See Figure 6). Avoid scratching the ceramic face, usually white.
4. Dispose of cardboard washer. Check again to see that ceramic surface is free of dirt and all other foreign particles and that it has not been scratched or damaged.
5. Assemble the collar (Ref. No. 4b), and seal (part of Ref. No. 4a) over the pump shaft sleeve (Ref. No. 5). If needed, a light coating of soapy water can be used on the inside of the seal bellows (part of Ref. No. 4 that fits onto the shaft) to facilitate for easier installation (see Figure 7).
6. Screw the pump shaft sleeve (Ref. No. 5) onto the motor shaft and turn clockwise until it bottoms. This location provides the proper seal tension for good surface contact between the seal and seat. If the key is assembled in the pump shaft before the shaft is threaded on, it will provide a better grip for tightening. Tighten setscrew (Ref. No. 11) on sleeve (See Figure 7).

NOTE: A short "run-in" period may be necessary to provide completely leak-proof seal operation.

NOTE: It will be necessary to remove plug in motor end cap to expose slot. If removed, be sure to reinstall plug AFTER pump is completely assembled.

7. Assemble the impeller (Ref. No. 7) over the pump shaft sleeve (Ref. No. 5). Make sure the impeller floats freely (see Figure 7).
8. Assemble the o-ring gasket (Ref. No. 8) and attach the cover (Ref. No. 9) with the (4) 3/8" diameter screws (Ref. No. 3). Torque to 15 to 20 ft-lbs.. (See Figure 7).
9. Before and after the plumbing is attached to the pump, make sure the pump turns freely. Rotate the pump by inserting a screwdriver into the back end of the motor and turning the motor shaft.

⚠ CAUTION ***Seal will produce some minor drag when spinning motor shaft, but rubbing anywhere else must be eliminated! Otherwise, damage to pump and/or motor may occur.***

SHERTECH® Close-Coupled Turbine Pumps

Bronze and Cast Iron Models

Seal Assembly Removal and Installation (Figures 4 thru 7)

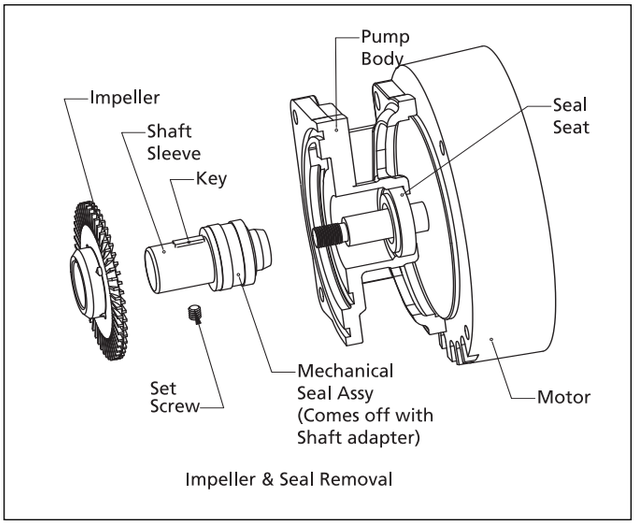


Figure 4 - Impeller, Sleeve and Seal Assembly Removal

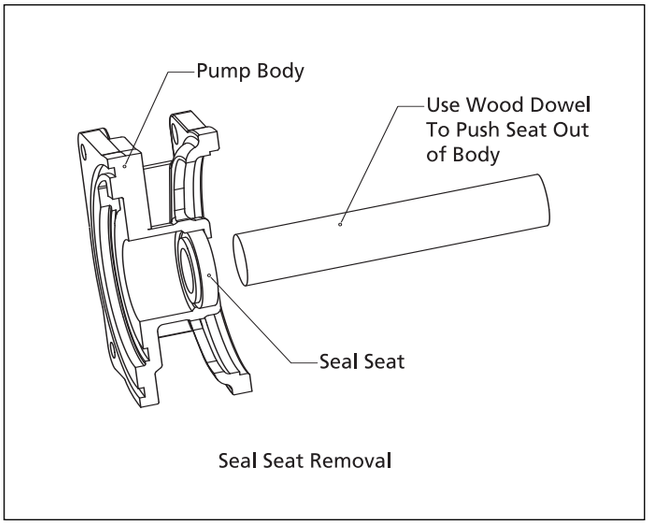


Figure 5 - Seal Seat Removal

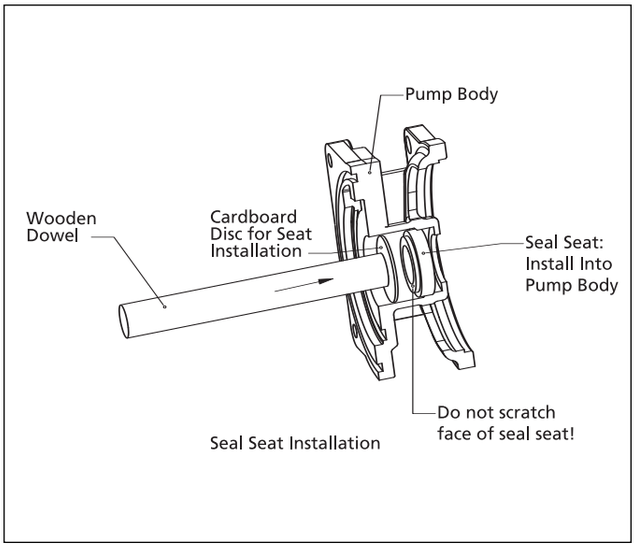

Pump Body
Wooden Dowel
Cardboard Disc for Seat Installation
Seal Seat: Install Into Pump Body
Do not scratch face of seal seat!
Seal Seat Installation

Figure 6 - Seal Seat Installation

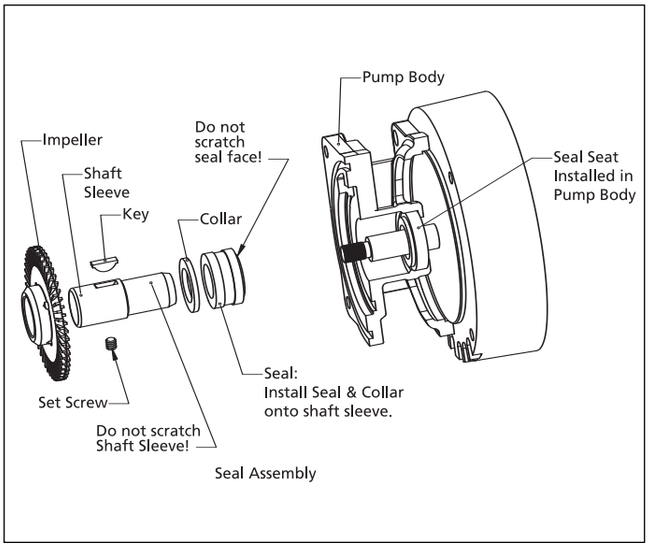


Figure 7 - Seal, Collar, Sleeve and Impeller Installation

Bronze and Cast Iron Models

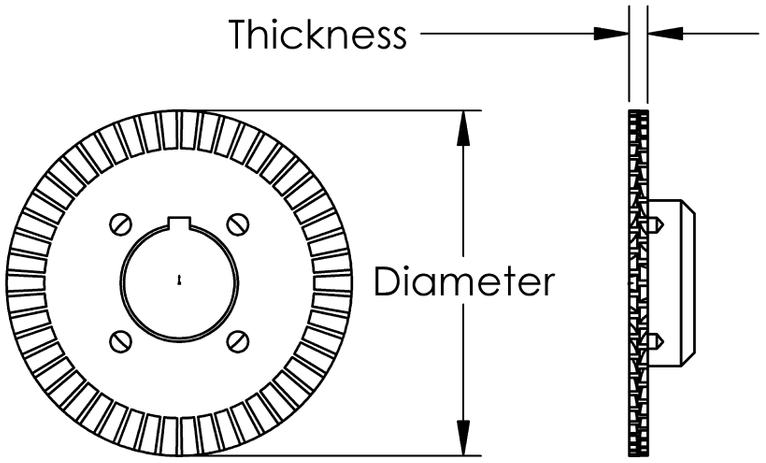
Troubleshooting Chart

Symptom	Possible Cause(s)	Corrective Action
Pump runs but no fluid	1. Faulty suction piping 2. Pump located too far from fluid source 3. Gate valve closed 4. Clogged strainer 5. Fouled foot valve 6. Discharge height too great	1. Replace 2. Relocate 3. Open 4. Clean or replace 5. Clean or replace 6. Lower the discharge point
Pump starts and stops pumping	1. Fouled impeller (dirt or particles in system) 2. Faulty mechanical seal 3. Leak in suction line 4. Leak in foot valve	1. Clean filter 2. Replace 3. Repair 4. Repair or replace
Pump stops pumping, motor/pump locked	Brass Parts imbedded on either side of impeller	Remove, dig out, file out burrs. Impeller should be smooth to touch
Flow rate is low	1. Incorrect speed 2. Piping is fouled or damaged 3. Clogged impeller or worn impeller 4. Discharge line restricted or undersized	1. Check drive 2. Clean or replace 3. Clean or replace 4. Flush out piping or replace
Excessive noise while pump in operation	1. Pump not secured to firm foundation 2. Piping not supported to relieve any strain on the pump assembly	1. Secure properly 2. Make necessary adjustment
Liquid drips from point where shaft enters the pump casing, when pump is full of liquid	1. Damaged mechanical seal 2. Temperatures over 160° F or liquid not compatible with seal	1. Replace (See maintenance) 2. Lower fluid temperature
Pump runs but poor performance	1. Check pump rotation to see if it is CCW as viewed from motor face. On three-phase motors, rotation must be checked prior to running pump under load. **⚠WARNING** ***Failure to check rotation before pump is run can result in severe damage to the pump and motor unit.***	1. On three-phase motors switch any two motor wire leads to reverse rotation.

Shertech® Close-Coupled Turbine Pumps
Bronze and Cast Iron Models

Impeller Identification Chart

Size	HP	GPM	Impeller Part #	Diameter (inches)	Thickness (inches)
1	3/4	4	13769	3.13	0.17
2	1-1/2	8	13770	3.41	0.20



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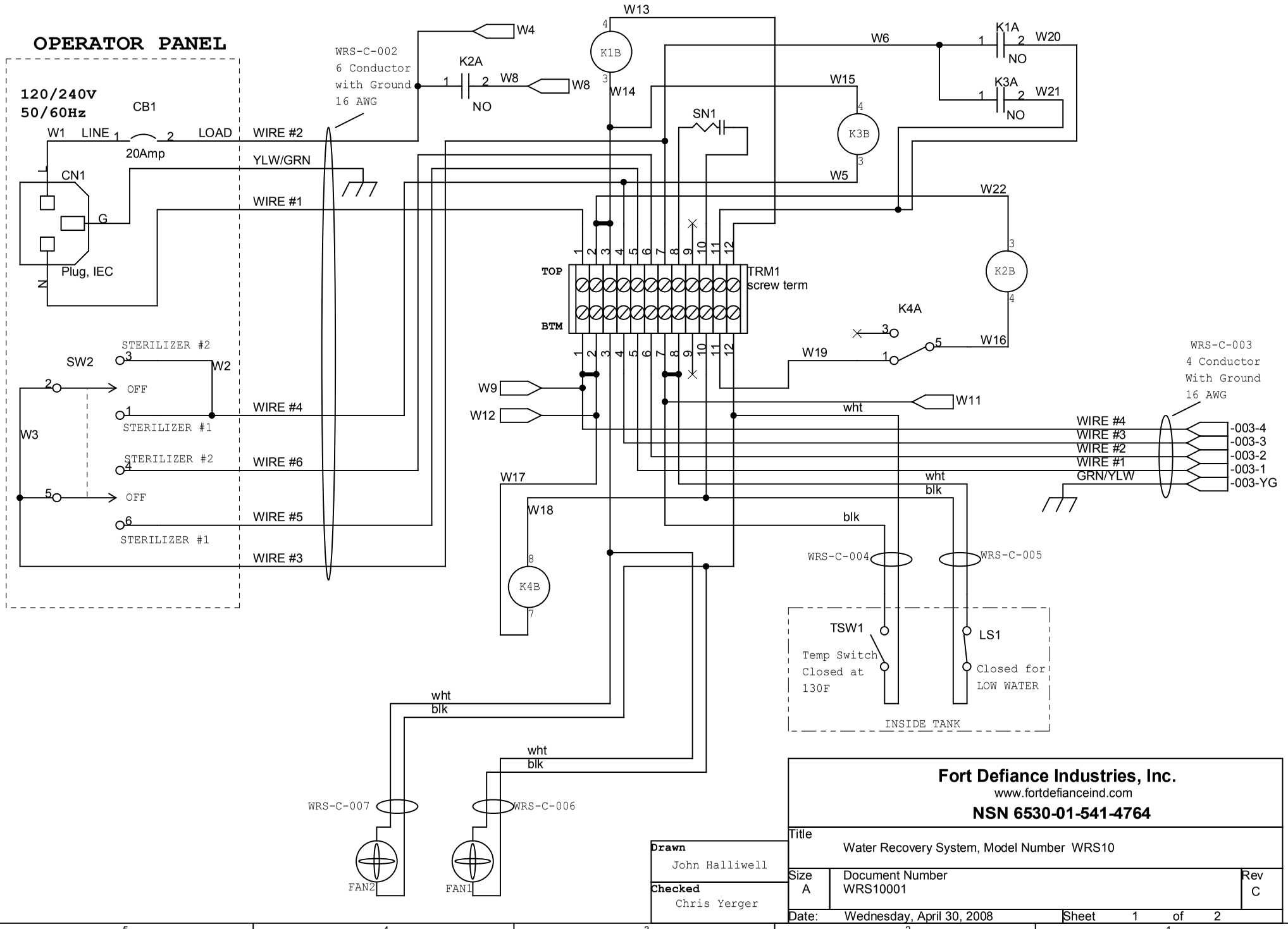
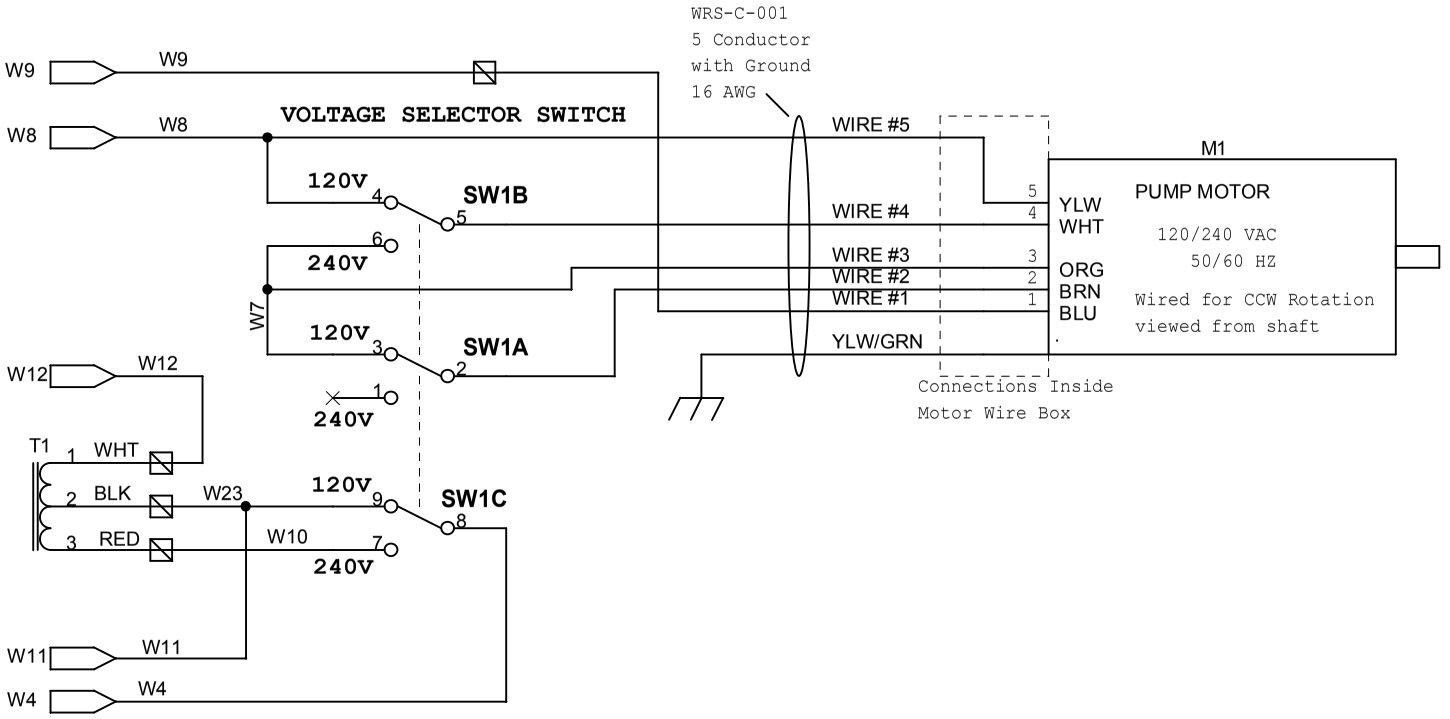
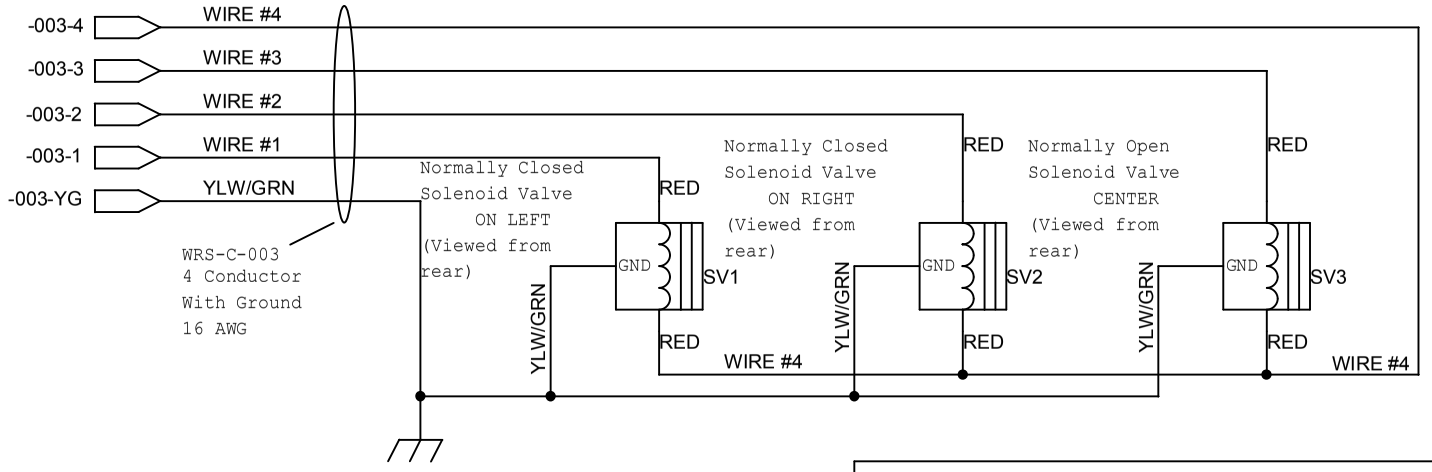


Fort Defiance Industries, Inc.	
www.fortdefianceind.com	
NSN 6530-01-541-4764	
Title	Water Recovery System, Model Number WRS10
Drawn: John Halliwell	Size: A; Document Number: WRS10001; Rev: C
Checked: Chris Yerger	Date: Wednesday, April 30, 2008; Sheet 1 of 2





Note: Indicates Wire Splice

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NSN 6530-01-541-4764

Drawn: John Halliwell	Title: Water Recovery System, Model Number WRS10	
Checked: Chris Yerger	Size: A	Document Number: WRS10001 — Rev: C
	Date: Wednesday, April 30, 2008	Sheet 2 of 2

Appendix F

Instructions for Connecting the Water Recovery System (WRS) to the 2151 Steam Sterilizer

Instructions for Connecting the Water Recovery System (WRS) to the 2151 Steam Sterilizer

1-1. SCOPE:

a. Step by step procedure for connecting the WRS to the 2151 Sterilizer.

b. Equipment Needed: 2151 WRS Adaptor Kit, 2151 Sterilizer, and WRS

c. Purpose of Equipment: The 2151 WRS Adaptor Kit modifies the Sterilizer, Surgical Instrument and Dressing, Pressure, Steam, Electric or Gasoline Burner Heated, Corrosion Resting Metal, NSN 6530-00-926-2151, (hereafter referred to as the 2151) so that exhaust can be collected, condensed and returned to the 2151 by the WRS.

d. Components of the 2151 WRS Adaptor Kit (Qty=1 of each). See Figure F-1 on next page.

1. Exhaust Hose
2. Return Hose
3. Operating Valve Hose
4. Garden Hose
5. Steam Collection Assembly
6. Electrical Cord
7. Return Connector
8. Operating Valve Hose Adapter
9. Pipe Plug
10. Teflon Tape

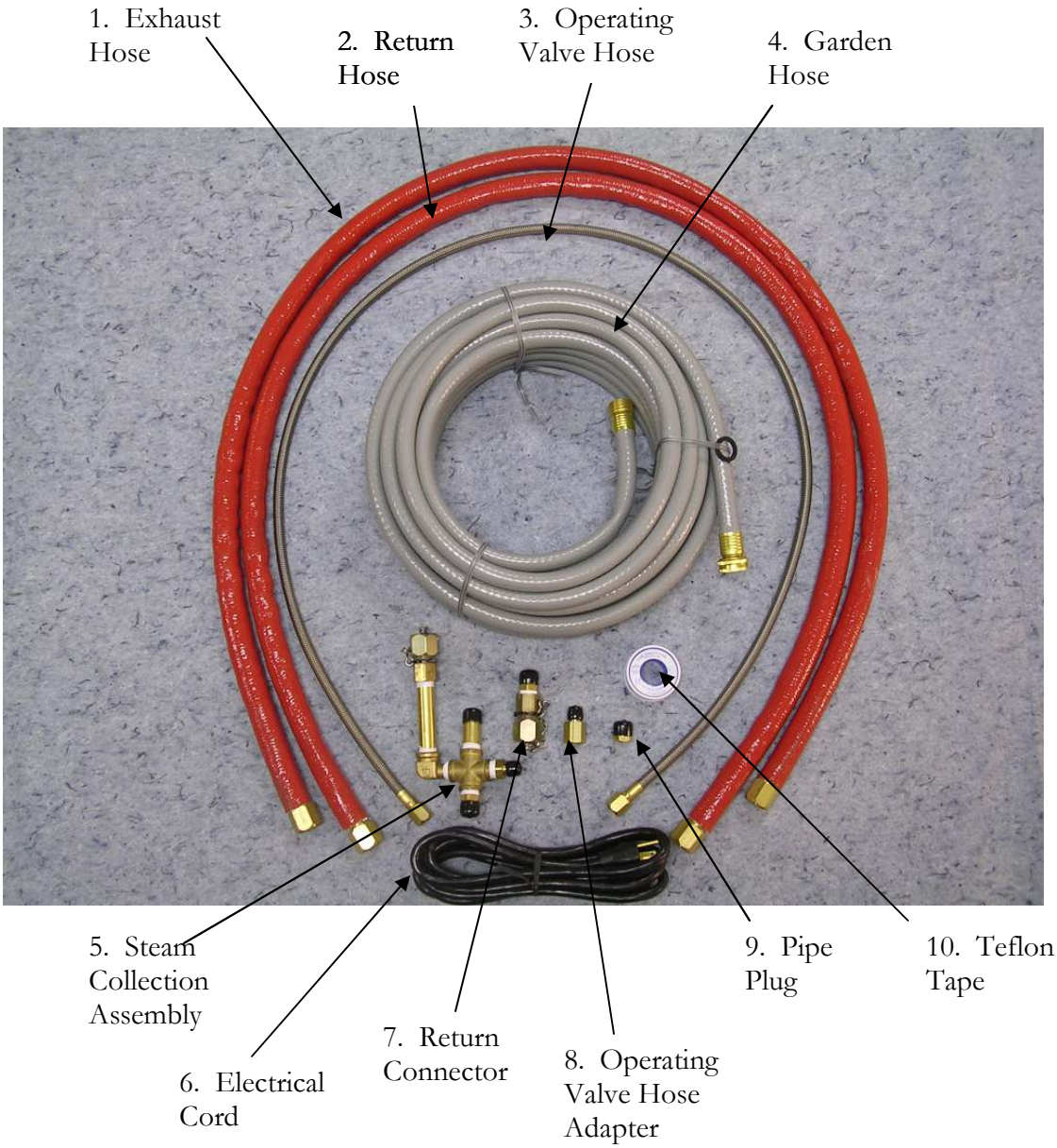

Figure F-1: Components of the 2151 WRS Adapter Kit

e. Tools needed to install the 2151 WRS Adapter Kit:

1. 11/16" opened end wrench
2. 3/4" opened end wrench
3. 7/8" opened end wrench
4. 1" opened end wrench
5. 1-1/8" opened end wrench or large crescent wrench
6. Pipe wrench
7. Medium-sized Phillips screwdriver

1-2. OPERATING PRINCIPLES. Once the 2151 WRS Adaptor Kit has been installed, the operating principles are as follows:

a. Steam exhausted from the 2151 operating valve and steam trap flows to the steam collection assembly, through the exhaust hose, and into the WRS, where it is condensed into water.

b. Water is returned to the 2151 through the return hose via the 2151 return connector installed in the boiler (near the heating assembly).

2-1. INSTALLATION OF 2151 WRS ADAPTOR KIT:

a. Preparation of the 2151: Disconnect the electrical power and drain the 2151 (see 2151 Operator's Manual).

b. <u>Staging the WRS:</u> Slide the WRS underneath the 2151 and between the support legs (Figure F-2). If a second 2151 is used, it should be placed on the left side of the first 2151 (when the operator is facing the first 2151 controls) so the operator will have access to the WRS controls.

Figure F-2: Staging the WRS Underneath the 2151

c. Steam Trap Assembly Removal: On the bottom front of the 2151, loosen the union nut on the inlet to the Steam Trap until it disengages from the threads on the steam trap. Remove the two ¼"-20 screws from the bottom of the 2151, and lift out the seam trap assembly. (Figure F-3).

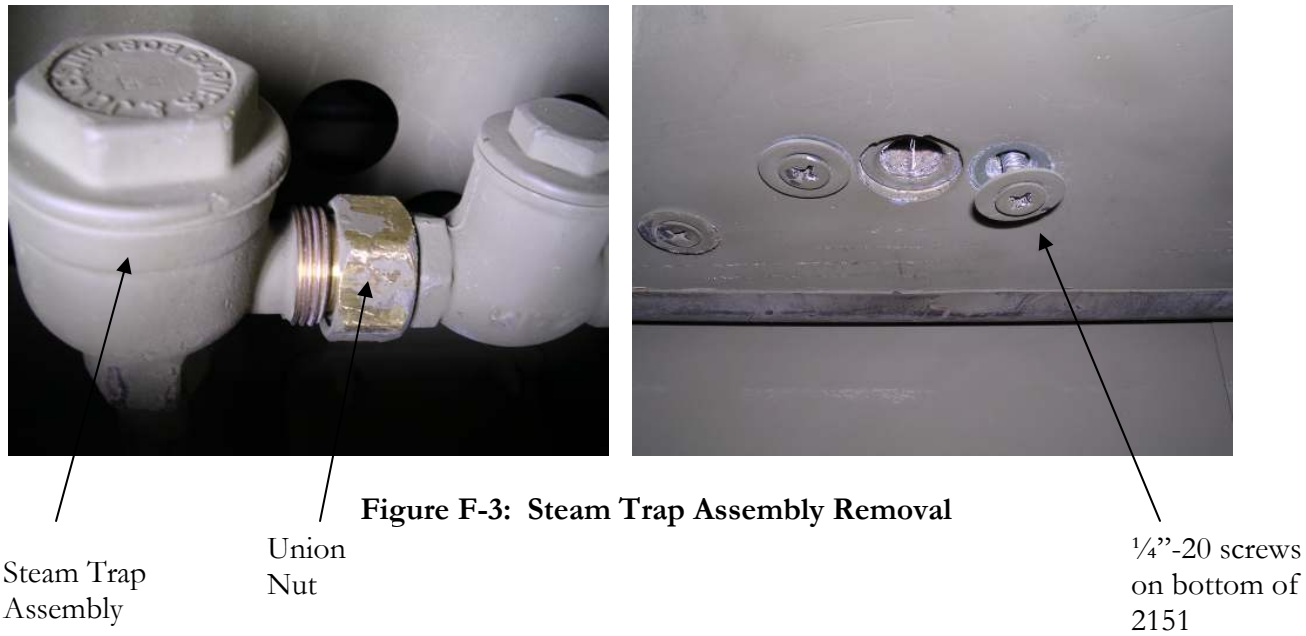

Figure F-3: Steam Trap Assembly Removal

c. Steam Trap Disassembly: Unscrew the pipe support, pipe nipple, and steam trap from each other (Figure F-4).

Figure F-4: Steam Trap Disassembly

d. Application of Teflon Tape: Apply Teflon tape to both 3/8" pipe nipples of the Steam Collection Assembly (top and bottom). Apply Teflon tape starting at the third thread from the end (skip the first two) and wind clockwise (Figure F-5).

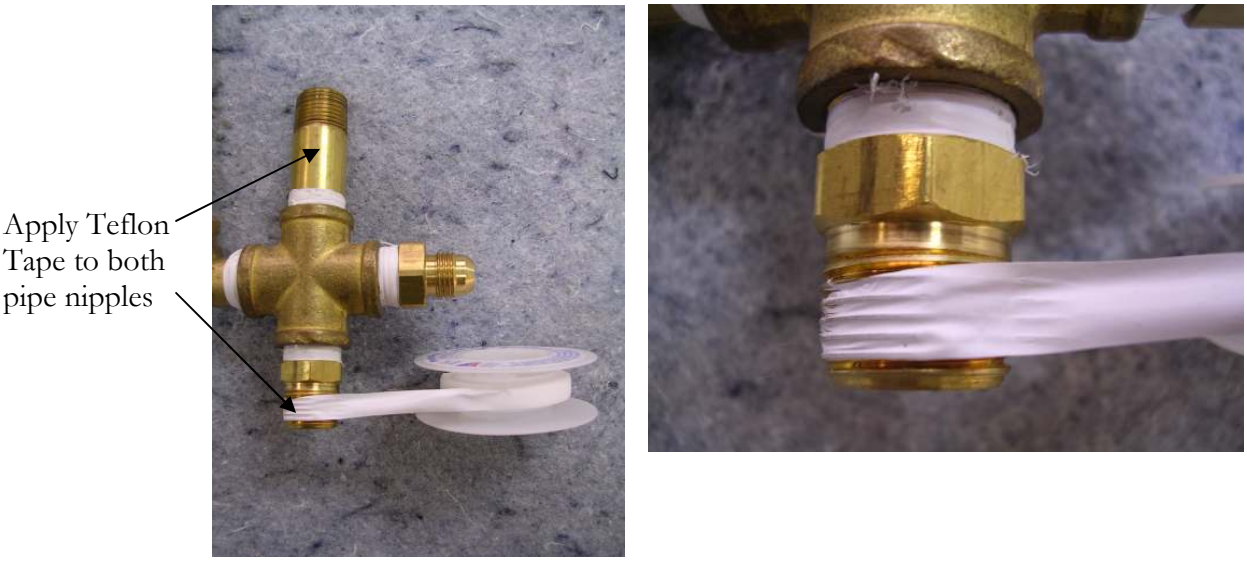

Figure F-5: Teflon Tape Application

e. Steam Trap Mounting: Tighten the Steam Trap to the top of the Steam Collection Assembly. Tighten the Pipe Support to the bottom of the Steam Collection Assembly. Tighten just the right amount to ensure an accurate height so that the assembly will mount to the floor of the 2151 and also fit-up properly to the steam trap inlet piping. Be sure to rotate the steam trap and the pipe support as shown to mate up properly with holes on the bottom and the inlet piping (Figure F-6).

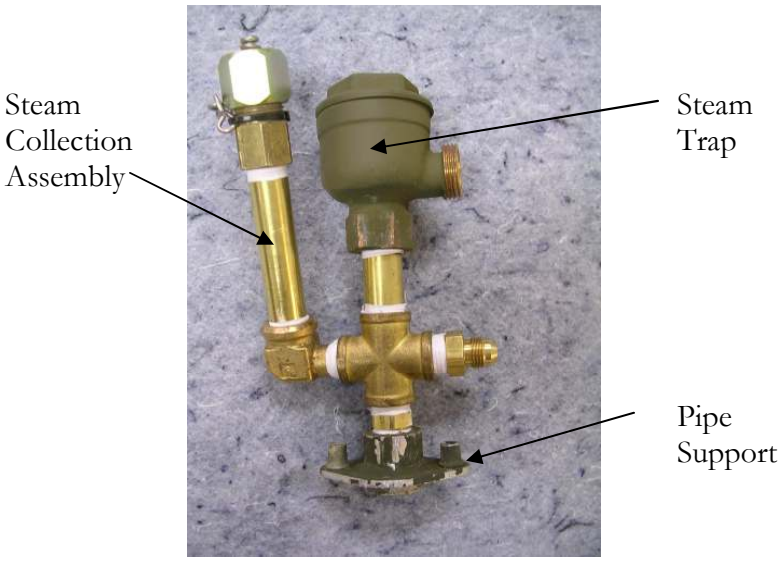

Figure F-6: Steam Trap Mounting

f. Operating Valve Hose Attachment: Tighten one end of the stainless steel Operating Valve Hose (uninsulated) to the new Steam Trap Assembly (Figure F-7).

Figure F-7: Attaching Operating Valve Hose to Stream Trap Assembly

g. Steam Trap Assembly Installation: Reattach the pipe support to the 2151 floor using the two ¼"-20 screws removed earlier. Attach the steam trap inlet pipe to the steam trap and tighten the union nut. Apply Teflon tape to the pipe plug and insert the plug into bottom of pipe support, inserting it through the floor of the 2151. (Figure F-8).

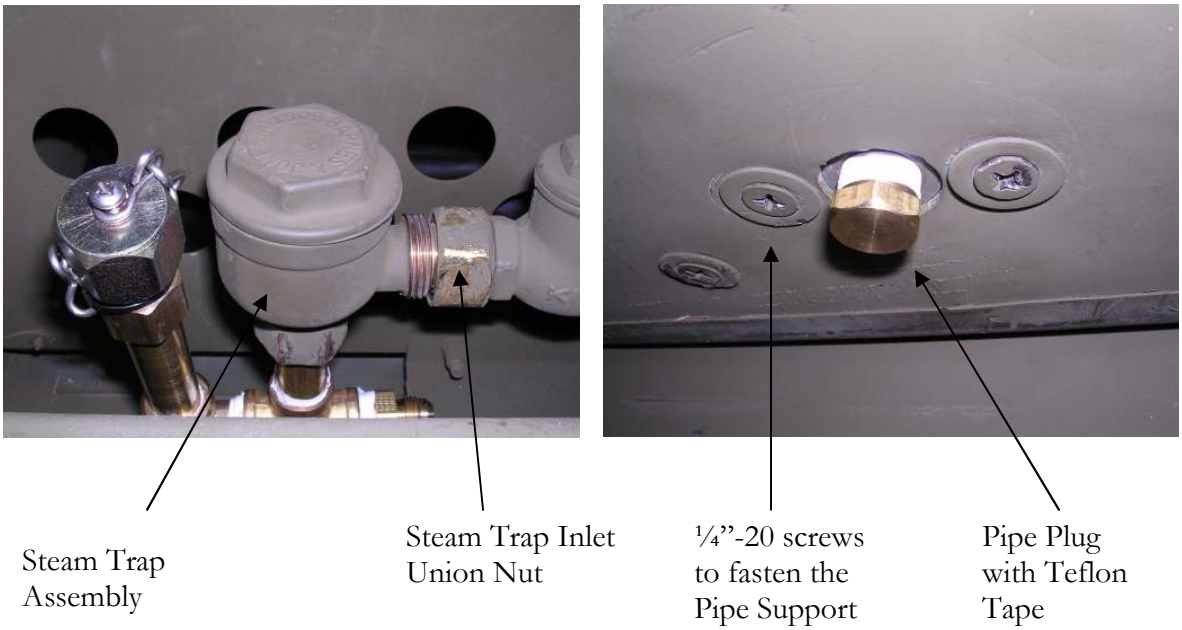

Figure F-8: Steam Trap Assembly Installation

h. Operating Valve Modifications: The Operating Valve is located on the top of the 2151. Loosen the Vent Tube Nut and move Vent Tube to the side (Figure F-8).

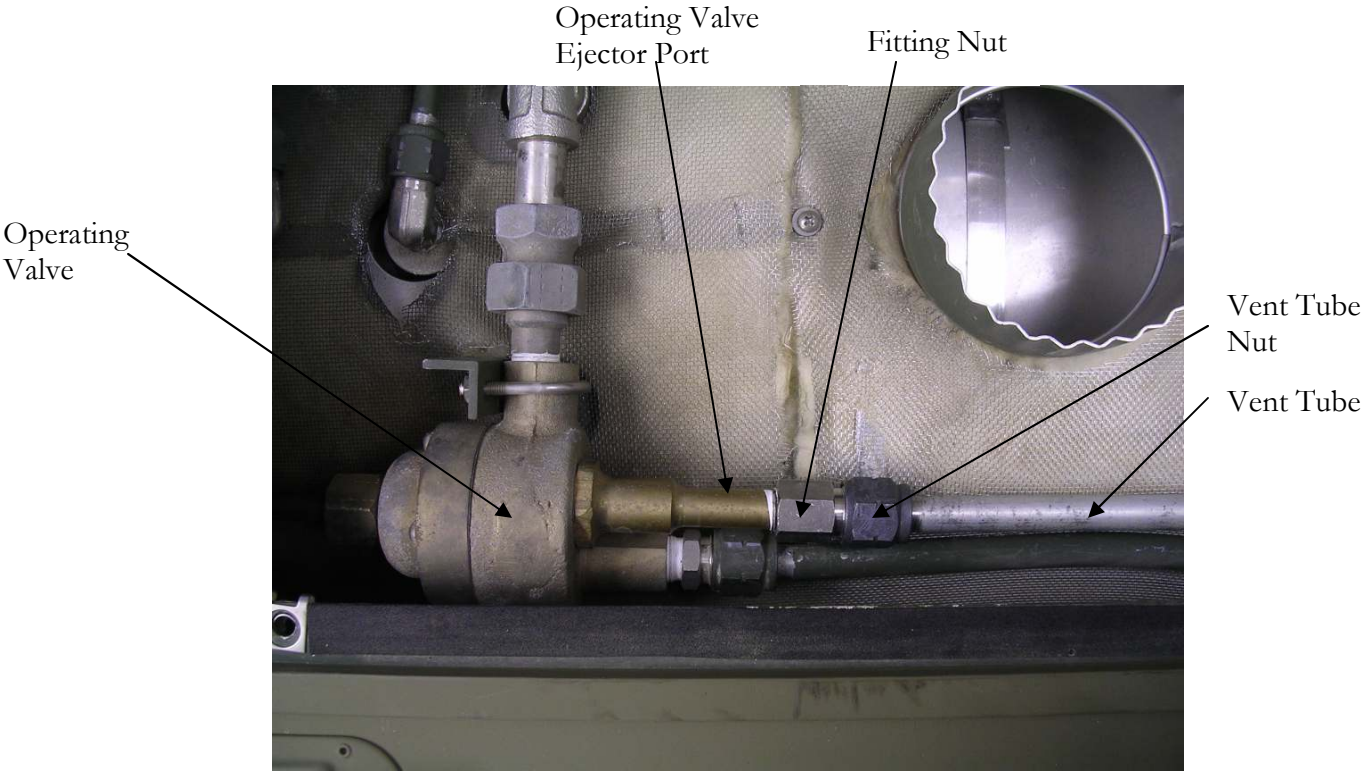

Figure F-8: Vent Tube Disconnection

i. Operating Valve Fitting Nut: Remove the Fitting Nut from the Operating Valve Ejector Port and apply Teflon tape to the pipe threads on the port. (Figures F-8 and F-9)

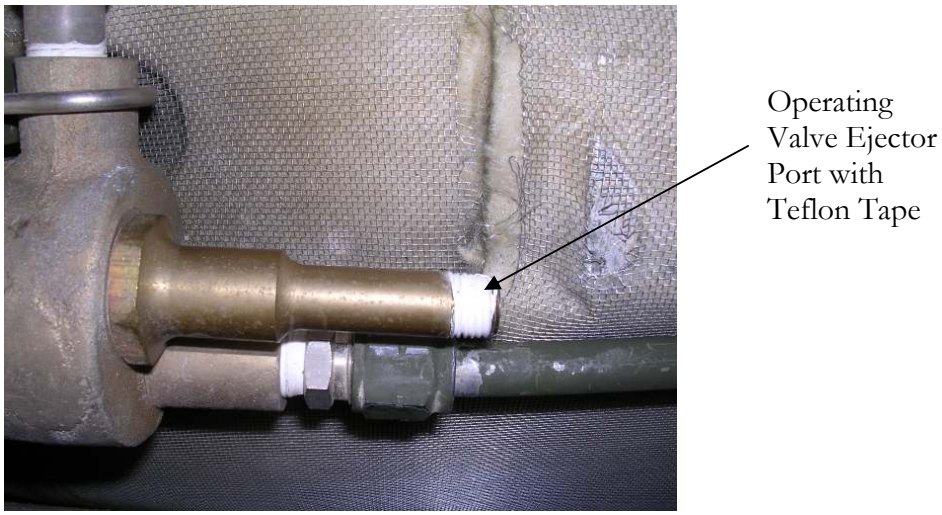

Figure F-9: Fitting Nut Removed and Teflon Tape on Ejector Port

j. Operating Valve Hose Adapter Installation: Thread the Operating Valve Hose Adaptor onto the Operating Valve Ejector Port and tighten (Figure F-10).

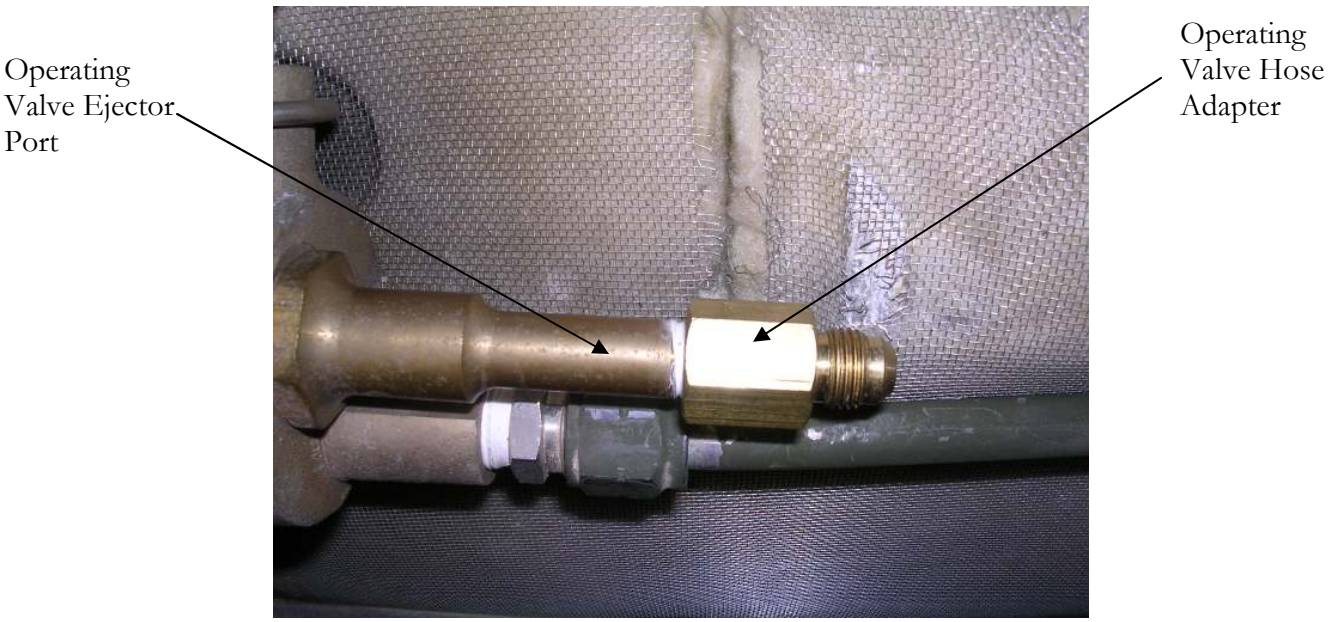

Figure F-10: Operating Valve Hose Adapter

k. Routing the Operating Valve Hose: Route the Operating Valve Hose through the front upper right corner of the 2151, and then loop around to connect to the Operating Valve Hose Adapter (Figure F-11). In order to fit the brass fitting of the hose through the corner opening, some metal may need to be filed away from the corner of the 2151.

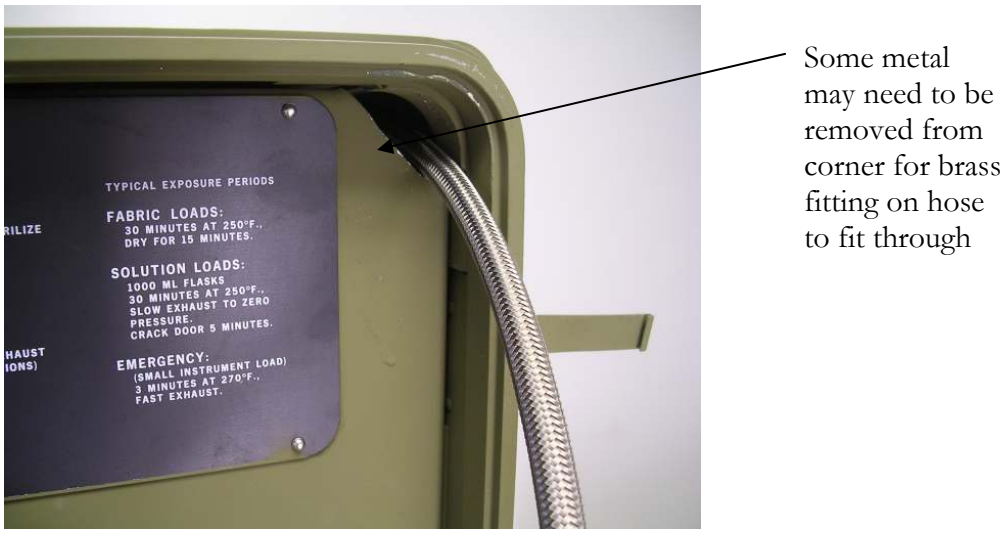

Figure F-11: Routing the Operating Valve Hose

l. Operating Valve Hose Connection: Tighten the flare nut on the Operating Valve Hose to the Operating Valve Hose Adaptor (Figure F-12).

Figure F-12: Operating Valve Hose Installation

m. Exhaust Hose Attachment to 2151: Remove the hydraulic cap from the Steam Trap Assembly, and tighten the Exhaust Hose onto this fitting (Figure F-13).

Figure F-13: Exhaust Hose Attachment

n. Exhaust Hose Attachment to WRS: Tighten the other end of the Exhaust Hose to the WRS inlet port labeled "Condensate from Sterilizer" (Figure F-14). (CAUTION: if two sterilizers are connected to the WRS, be sure that the hose is connected to the correct port on the WRS – either Sterilizer #1 or #2.)

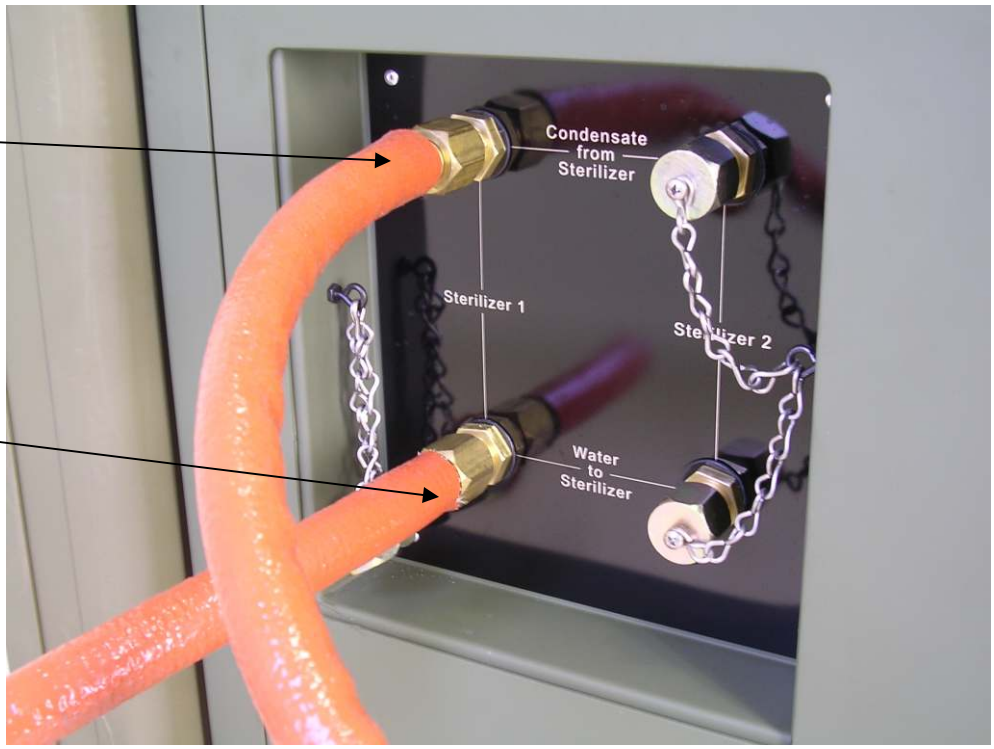
Exhaust Hose connected to the "Condensate from Sterilizer" port on WRS
Return Hose connected to the "Water to Sterilizer" port on WRS (reference step "p")
Condensate from Sterilizer
Sterilizer 1
Water to Sterilizer

Figure F-14: Exhaust and Return Hose Connections to WRS

o. Return Connector Installation: Facing the back of the 2151, locate the left hex head pipe plug underneath the heater assembly (Figure F-15). Remove this pipe plug from the boiler port. Apply Teflon tape to the Return Connector threads. Thread the return connector into the boiler port and tighten.

Figure F-15: Installation of Return Connector.

p. Attachment of Return Hose: Remove the hydraulic cap from the Return Connector, and Attach the Return Hose to the Return Connector (Figure F-16). Attach the other end of Return Hose to the WRS (see Figure F-14).

Figure F-16: Attachment of Return Hose to Return Connectyor

q. Attachment of Garden Hose: Attach the Garden Hose to the Drain/Fill Connection on the front of the WRS (Figure F-17). This hose can be used to fill the WRS and ultimately the 2151 (see WRS Technical Manual).

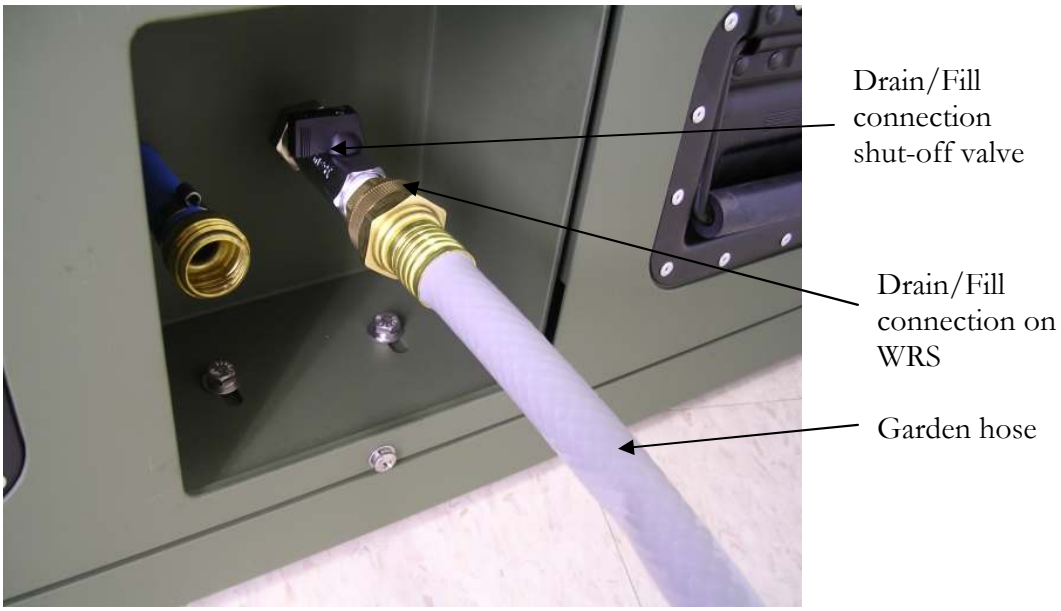

Figure F-17: Attachment of Garden Hose to Fill/Drain Connection

r. Connection of Electrical Cord: Ensure the Power Switch on the WRS is turned off. Connect the Electrical Cord to the plug on the operator control panel of the WRS (Figure F-18). Connect the other end of the Electrical Cord to a 115/120V power source.

If the power source is 208-240 Volts, see the WRS Technical Manual on how to easily change unit setup. WARNING: Failure to follow this procedure for 240 Volts 50 Hz could severely damage the WRS electrical system (Figure F-19).

Figure F-18: Connection of Electrical Cord to WRS

Figure F-19: Warning Label for 240 Volt 50 Hz Electrical Connection

s. Check for Water Leaks: Fill the WRS according to WRS Technical Manual. Follow the WRS and 2151operating procedures to operate the unit and inspect for leaks. Tighten any connections that may be leaking.

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